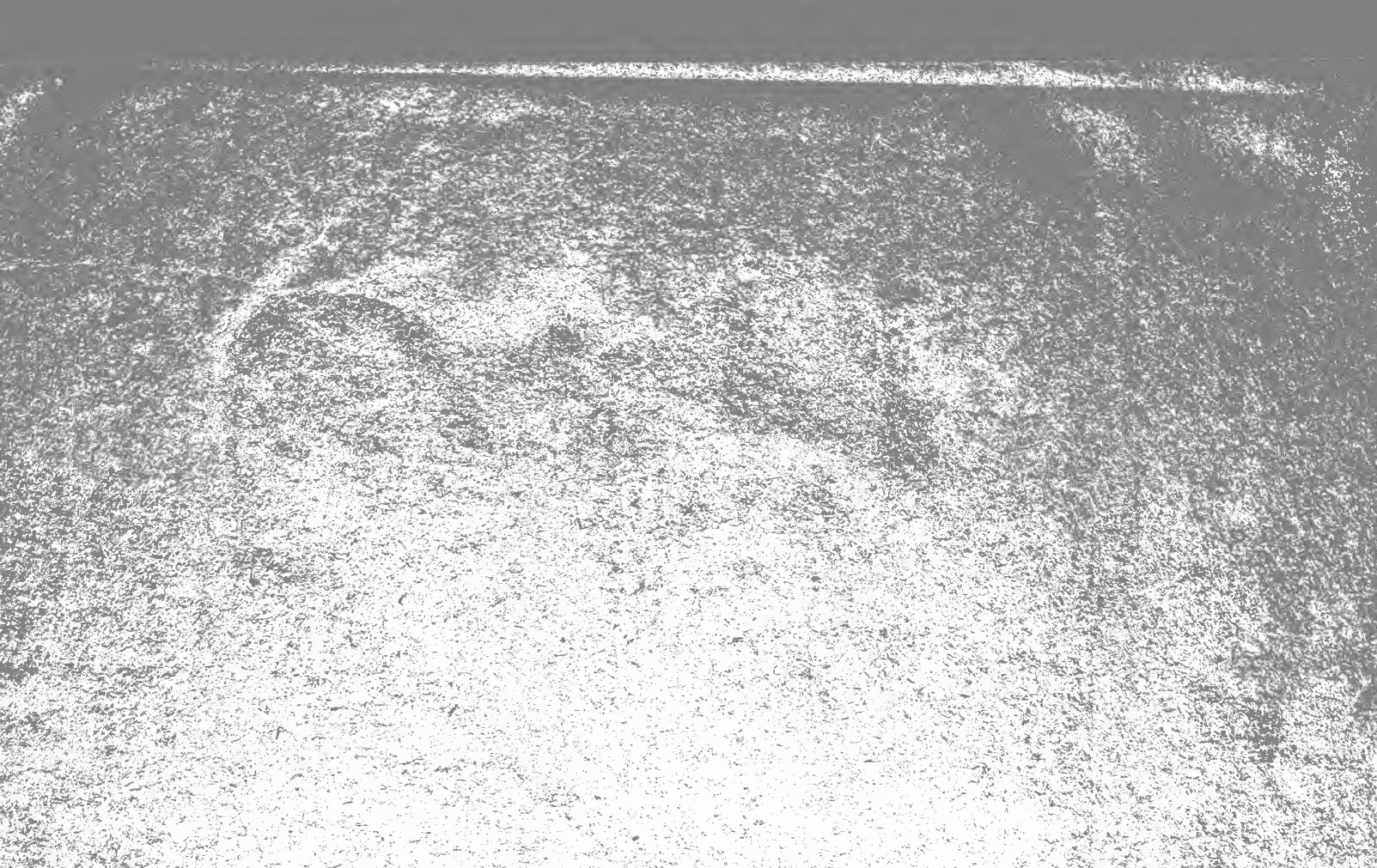

VARIATION IN THE ACHIEVEMENTS OF PUPILS

A STUDY OF THE ACHIEVEMENTS OF PUPILS IN THE FIFTH AND SEVENTH GRADES, AND IN CLASSES OF DIFFERENT SIZES

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C. H. E.

VARIATION IN THE ACHIEVEMENTS OF PUPILS

INTRODUCTION

In the past decade much has been done in the development of units and scales for the measurement of educational products. No less important has been the development of methods of applying these and other instruments of scientific procedure to the problems of education. This whole movement is but a part of a larger one which has in recent years extended the scope of the applied sciences and utilized the principles of science in the improvement of many lines of human endeavor.

In the succeeding pages there is presented a sample study which utilizes those methods of educational measurement that may be applied to ordinary school situations. The achievements of more than seventeen hundred children in the fifth and seventh grades have been measured in the several subjects of arithmetic, English composition, spelling, handwriting, and range of vocabulary. The results are gathered into tables and may be used as tentative standards for evaluating the work of a school system in these subjects. The achievements, the variabilities, and the amounts of growth are symptomatic of the performance of the children in these grades and may be used further as a starting point for the derivation of better standards. These summaries are presented in Chapter III and are not repeated in the last pages of this study.[1]

One further problem has been considered. The size of class in which the children have been taught has been studied from the records of the seventeen hundred pupils. To supplement these, records of more than ten thousand children in four hundred forty-four classes have been utilized. These records include attainment in spelling and oral arithmetic, and measurements of growth by classes for a period of seventeen weeks in language and handwriting in two city school systems in which the testing

[1] It should be noted that all possible problems have not been studied. The influence of sex, age, and the like could have been studied in detail if the limits of the present investigation had permitted.

was done under the same conditions of supervision. The findings derived from a study of this phase of the problem are valid in so far as the nine systems are typical of American practice.

One of the chief contributions which a study of this type can make is the method of standardized investigation which it develops. It offers a tentative standard for comparison in testing the efficiency of the same grades in other systems under survey. In order that the study may be of service to those who wish to make scientific measurements of school work in these subjects, a very carefully prepared list of the tests together with detailed directions for their administration and the evaluation of results is presented in the Appendix.

CHAPTER I

THE MEASUREMENT OF EDUCATIONAL EFFICIENCY

In this age of scientific advancement we hear an insistent demand for the measurement of efficiency. The movement known as "scientific management" to-day affects not only the organization of industry but its methods are being incorporated into nearly every line of human endeavor and are now being applied in education. The notable contributions in educational research in the past six years include many studies and methods that can be applied in the measurement of education with a precision comparable to that of some of the applied sciences.

We may consider the measurement of educational efficiency from a great many angles. For many years, we have measured automatically the efficiency of higher education in the definitions of what constitutes an institution of higher learning which we find in the laws of the various states, in the definitions of the United States Bureau of Education, the Carnegie Foundation for the Advancement of Teaching and many voluntary associations that deal with this phase of education. Definitions and standards covering such elements as the amount of endowment, income, entrance requirements, curriculum, plant, time allotment and teaching staff have been formulated. In the field of secondary education the definitions of entrance requirements formulated by agencies which deal with institutions of higher learning have been utilized as norms of attainment by the secondary school. Further, associations formed to deal primarily with secondary school problems and the accrediting body of various institutions of college grade, particularly the State universities of the Middle West, have formulated rather elaborate definitions and standards which cover such elements

as plant, class size, time allotment, preparation and certification of teachers and the content of the curriculum.[1]

Elementary education has not been standardized in the same manner. Aside from the standardization of curriculum attempted in 1895 by the Committee of Fifteen, nothing comparable has been done. The studies of time allotment have been of little significance. But it should be noted that the most recent developments in methods of measurement and administrative technique deal in great part with elementary education.

In any study of the measurement of education we may deal with these more formal aspects. Or we may deal with those findings that have assisted in developing more adequate methods of studying the school population, children in school, health of children, the school plant, school receipts and expenditures and, as a by-product of these, the improvement of school records. Another course open to us is to study the achievements of children in various school subjects. This enables us, by employing standard tests and the various units and scales of measurement that have been devised, to measure directly products of children's work in these particular subjects and more indirectly to measure the process of education. This is the method that has been selected in the study here reported.

The pioneer work of Rice,[2] Cornman,[3] Stone,[4] Courtis,[5] and others[6] suggested the possibility of developing standard tests. The field of knowledge was not advanced beyond this point

[1] For excellent examples of this, see the reports of the North Central Association of Colleges and Secondary Schools. See also the definitions of units and discussions of entrance requirements for universities which admit by certificate, *e.g.*, Illinois, Wisconsin, Michigan.

[2] The Futility of the Spelling Grind, *The Forum*, Vol. XXIII, pp. 163-172 and 409-419.

Educational Research: A Test in Arithmetic, *The Forum*, Vol. XXXIV, pp. 281-297.

Causes of Success and Failure in Arithmetic, *The Forum*, Vol. XXXIV, pp. 437-452.

Educational Research: The Results of a Test in Language, *The Forum*, Vol. XXXV, pp. 269-293.

Language (continued): The Need of a New Basis in Education, *The Forum*, Vol. XXXV, pp. 440-457.

[3] Spelling in the Elementary School: An Experimental and Statistical Investigation.

[4] Arithmetical Abilities and Some Factors Determining Them, Teachers College Contributions to Education, No. 19.

[5] The Courtis Tests, Series A.

Final Report of the Committee on School Inquiry for New York City, Vol. I, pp. 397-546.

[6] Bliss in *Psychological Clinic*, Vol. VI, No. 1, pp. 1-12,

until Professor Thorndike in 1910 developed the first scale for the measurement of an educational product.[7] In his published description, Professor Thorndike presents scales for the measurement of the quality of handwriting of children in the elementary grades and also for the measurement of the handwriting of women. In the derivation of these scales, use was made of the methods devised by Galton, Pearson, Cattell and other students of variable quantities. Scores were derived from the judgments of educational experts. By a careful study of the variability of these ratings, and by utilizing the principle that differences equally often noticed are equal, relative values of the samples were determined and the scales formed. The handwriting scales consist of a series of samples of handwriting with which the specimens to be measured are compared.

In 1911, Dr. L. P. Ayres, of the Russell Sage Foundation, derived and published a scale for the measurement[8] of legibility in handwriting. This scale was derived in a manner radically different from that utilized by Professor Thorndike. Legibility was measured in terms of the time that it takes competent judges to read samples of handwriting. After eliminating the practice effect upon the time taken to read the samples, they were arranged along a scale of difficulty taken as a function of the time required to read the samples. From a comparison of the form of distribution of these samples with the normal surface of frequency, the values of the samples were obtained.

In 1912, Professor Milo B. Hillegas of Teachers College derived a scale for the measurement of quality in English Composition by young people.[9] The derivation of this scale was made by the same methods that had been utilized by Thorndike in the derivation of the handwriting scale. The completed scale represents a series of compositions with values from 0 to 9.37. Compositions are graded by comparing the specimens with the series of samples which constitute the scale.

In 1913, Dr. B. R. Buckingham, now statistician of the New York Board of Education, derived a scale for the measure-

[7] This list merely summarizes the most significant studies in educational measurement. The literature of statistics and psychology includes much valuable material and many suggestive methods.

[8] Bulletin of the Division of Education, Russell Sage Foundation, 1912. No. 113.

[9] *Teachers College Record*, September, 1912.

ment of spelling ability of children in grades three to eight inclusive.[10] Dr. Buckingham's method of deriving his scales utilizes in part the method discussed above, but, in addition, he studied the overlapping of grade upon grade, utilizing in these studies nearly ten thousand records. By the use of these scales, we are able to rate words in terms of "difficulty to spell." For example, "circus" and "carriage," "touch" and "surface" are approximately of equal difficulty.[11] Dr. Buckingham has in the past few months extended the results of this study until he now has records of nearly twenty thousand children. He states that there is practically no change in the position of the words on the scales as originally printed.

In 1913, Professor Thorndike derived by a method similar to the method utilized in the derivation of the handwriting scale, a scale for the measurement of ability in drawing[12] of children in the grades of the elementary school. In addition to this he has made in the past two years important contributions to method in his suggestions of improved methods[13] for handling and interpreting data and in his suggestive studies of expectancy.[14]

[10] Spelling Ability, Its Measurement and Distribution, Teachers College Contributions to Education, 1913, No. 59.

[11] Measured by the per cent of fifth and fourth grade children respectively who spell the pairs correctly. The pairs are not at precisely the same point on Buckingham's scale.

[12] *Teachers College Record*, November, 1913.

[13] Mental and Social Measurements, 1913 (second edition).

[14] (a) Educational Diagnosis: Vice-Presidential Address, American Association for the Advancement of Science, 1912, *Science*, N. S. Vol. 37, Nos. 943 and 946. For a discussion of the data on which a part of this address depends, see The Elimination of Pupils from the High Schools of New York, by Van Denburg, The Correlation of Mental Abilities, by Simpson, and Educational Administration, by Strayer and Thorndike.

(b) Educational Administration, by Strayer and Thorndike.

(c) Teachers College Alumni Bulletin, 1913.

CHAPTER II

THE DATA. THE TESTS. THE METHOD OF SCORING

The selection of schools in which the testing has been done has been made upon the basis of a random sampling which would insure the inclusion of all types of schools, i.e., small city, medium sized city, suburban city, and large city. This random selection was extended sufficiently to be certain that the different levels of school population, such as poor American, good American, extraordinarily good American, foreign and low grade foreign, were included. To this end forty classes in fourteen schools in five groups have been critically studied. In addition to these there are presented four hundred forty-four class records of tests in language, handwriting, spelling and oral arithmetic. These records represent a random sampling from many more classes in two cities, one in New York and the other in Massachusetts, in which the testing was not done by the author but by an exceptionally competent superintendent under controlled conditions. The papers were scored by an experienced teacher who at the same time is a competent statistical clerk. These classes included about ten thousand children. In the forty classes which are widely distributed in the schools of New York, New Jersey and New England, seventeen hundred twenty pupils have been measured in the five traits, arithmetic, spelling, English composition, penmanship, and range of vocabulary. In several hundred instances, several scorings have been made of the work so that the number of records of pupils actually utilized in this study is somewhat more than twenty thousand.

Although it is evident that the careful measurements which have been made of the seventeen hundred twenty children in forty classes, involving as wide a distribution as to territory, school population, and mental abilities, as is described above, are more than a sufficient basis for determining the symptoms of relationship between class size and attainment, nevertheless,

every possible source of material has been canvassed so far as the limits of this study would permit.

Section 1

The Tests and Their Administration

In the following paragraphs are described the tests which have been selected, the reasons given for choosing them and the de tailed directions for their administration. In every instance[1] the tests have been given by the author. Through the courtesy of the supervisory officers of all of the systems tested the writer was permitted to use the paper utilized by the school in its regular work in each of the subjects tested. For this reason no mention is made in the succeeding pages of the selection of paper. Pens were also generously supplied so that the conditions under which the pupils did their actual school work were not changed in any important detail.[2]

SPELLING

Various studies of the spelling of school children have been made. The most important are those by Cornman,[3] Rice,[4] Wallin,[5] Buckingham,[6] and Thorndike and Earle.[7]

In his elaborate study of spelling Buckingham has been able by the methods utilized by Thorndike[8] to make fairly accurate scales for spelling ability for grades three to eight inclusive. A careful study of these scales has revealed the fact that certain words have an equivalence, that is, to spell " carriage" requires approximately the same amount of spelling ability as to spell " believe."

[1] With the exception of Tests I, II and III in range of vocabulary, which were given by a trained investigator in a single room under the immediate supervision of the writer, and the tests in arithmetic in System D.

[2] Had this not been possible then a uniform paper and a uniform pen would have been selected.

[3] Spelling in the Elementary School: An Experimental and Statistical Investigation.

[4] The Futility of the Spelling Grind, *The Forum*, Vol. XXIII, pp. 163-172 and pp. 409-419.

[5] Spelling Efficiency in Relation to Age, Grade and Sex, and the Question of Transfer.

[6] Spelling Ability, Its Measurement and Distribution, Teachers College Contributions to Education, No. 59.

[7] Heredity, Correlation and Sex Differences in School Abilities. Columbia University Contributions to Philosophy, Psychology and Education, Vol. XI, No. 2.

[8] *Op. cit.*

The words selected are those that are spelled by approximately fifty per cent of the grade tested. They are equivalent in that sense although they do not stand at precisely the same point on Buckingham's scale. Comparisons of grade status may be made in terms of the per cent of the grade which spells correctly these median words or by the use of Buckingham's scale.

DIRECTIONS FOR GIVING THE TESTS IN SPELLING

Upon entering the classroom there was obtained from the teacher a sufficient amount of ruled paper such as was used for ordinary composition work to supply each pupil with one sheet. The paper was distributed by the regular monitors. These directions were then given:

"Write your name in the upper right-hand corner of the sheet. Under this state whether you are a boy or a girl. Under this write the date of your birthday. Under this write the number of years old you were at your last birthday.

"I wish you to write carefully some sentences which I shall dictate. Number them in order on the left."

Sentences containing these standard words[9] were then dictated:

Fourth Grade:
wear, button, touch, surface.
Fifth Grade:
believe, loose, circus, carriage.
Sixth Grade:
saucy, whistling, beginning, succeed.
Seventh Grade:
ascending, slipped, imagine, character.
Eighth Grade:
peculiar, mixture, intelligent, occasion.

In dictating the sentences each one was read through twice and then dictated in phrases as marked, allowing the number of seconds per phrase for writing indicated above each phrase.[10] When the last sentence had been dictated, and time allowed for writing the last phrase, this signal was given:

"All stop. Pens down. Blot your work. Monitors collect."

[9] Spelled correctly by approximately fifty per cent of the pupils in the grade.

[10] See Appendix.

PENMANSHIP

In the past six years, a large number of important studies of the teaching and rating of penmanship have been made. Reference is made specifically to the work of Thompson,[11] Houston,[12] Ayres,[13] and Thorndike.[14] Professor Thorndike, during the years 1908-1910, developed the first scale for the measurement of handwriting. This scale and the one developed by Ayres have proved to be very serviceable means for accurately rating specimens of penmanship. After a careful study of the merits of the two scales and of the work that has been done with the Thorndike scale in a number of school systems, it was determined to utilize the Thorndike scale in all of the measurements which are here presented. The method of administering the handwriting tests is given below. In this study, the effort is made also to determine quantitatively the amount a child can write. It is not fair to rate a class or a system on quality alone.

THE TESTS IN HANDWRITING[15]

1. Upon entering the classroom there was determined from the teacher what piece of poetry or prose containing thirty or more words had been memorized by the pupils. Often it was found that different groups knew different passages best. In that case each group was allowed to use what it knew best in the preliminary test. In Tests II, III and IV, it was found advisable to attempt to confine the writing to two different passages, preferably one, because of the difficulty in getting the passages on the board as noted below.

2. Utilizing the regular monitors, one sheet of paper per pupil and pens in holders were distributed to the class. Care was taken to see that all were supplied with ink and blotters.

3. The class was instructed to prepare this sheet by writing name, birthday, age, and sex as indicated under the Spelling Test.

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[11] Psychology and Pedagogy of Writing.

[12] Manual of Penmanship and Guide to Rating, New Haven, 1912.
For studies in the physiology of handwriting, the reader is referred to the work of Judd, Freeman and others.

[13] A Scale for the Quality of Handwriting of School Children, Bulletin of the Russell Sage Foundation, 1912, No. 113.

[14] Handwriting, *Teachers College Record*, March, 1910.

[15] In the Appendix the detailed directions are given so that any one who wishes to repeat these tests can reproduce the conditions exactly.

4. Test I. *Preliminary Test.* The pupils were asked to write the first stanza of the passage selected over and over from memory in exactly two minutes. While the class was writing the names of any who did not remember the passage were recorded. At the end of that time, the papers were collected, fastened together, labelled as indicated for the other tests, and in addition they were marked, Preliminary, 120 seconds.

5. Test II. *Careful Writing Test.* The teacher was asked to write the stanza on the board. If there were two or three groups, the investigator wrote one or more of the passages on the board, thus assisting the teacher and saving time. The pupils were then told that we were anxious to see how well they could write. They were told to write the first stanza over and over as carefully and as well as they could in the time allowed. They were told to look at the board if they forgot the passage. They were started on signal and allowed exactly four minutes. Papers were collected, labelled, and Careful, 240 seconds, was added.

6. Test III. *Writing Done At The Usual Rate Of Writing.* The children were then told that the author wished to see how they wrote when they wrote about as rapidly as they ordinarily do. The same directions were given for the writing as indicated under (5). They were started on signal and allowed exactly four minutes. Papers were collected and labelled as indicated above. Additional label, Ordinary, 240 seconds.

7. Test IV. *Speed Writing.* " Now let us see how you can write when you write very rapidly." Paper was distributed as before. " When I say ' Go,' take your pens and write the stanza over and over again until I say ' Stop ! ' Remember, write as rapidly as you can and still write well." The procedure was the same as in Test III and four minutes were allowed; the papers were labelled in addition, Speed, 240 seconds.

ENGLISH COMPOSITION

The most important studies of the achievement of pupils in the elementary school in English composition have been made by Rice,[16] Bliss,[17] and Hillegas.[18] These studies suggested

[16] Educational Research: The Results of a Test in Language. *The Forum, op. cit.*

[17] *The Psychological Clinic*, Vol. VI, No. 1, March 15, 1912, pp. 1-12.

[18] The Measurement of Quality in English Composition, *op. cit.*

among other things the need of much work in the selection of a theme. After a large amount of preliminary experimental work with children's compositions and after a conference with a number of prominent teachers of English, the most helpful of whom was Professor Franklin T. Baker of Teachers College, it was decided that the subject best fitted for a test in English Composition is one which fulfills the following conditions:

1. The subject must be within the range of the pupil.
2. It must be a subject that will awaken his lively interest.
3. It must be a subject that will challenge his best endeavor.

In addition to the conferences with these teachers of English, the author examined with great care a dozen of the best language books and on the basis of this examination made out a list of subjects.[19] After preliminary experimenting, the following was selected as the subject which most nearly conforms to the conditions noted above and fulfills the added requirement that fifth and seventh grade children are able to write freely upon it:

"*How I would spend one hundred dollars to please five persons who like different things.*"

The results which have been obtained from the fifth and seventh grades are ample justification for its selection. The directions utilized in giving the composition test are as follows.

THE METHOD OF ADMINISTERING THE COMPOSITION TEST

One sheet of paper was distributed to each pupil. The pupils were asked to prepare the paper in the same manner as they had prepared their spelling papers. They were then directed to put their pens down and listen carefully to the following directions:

" To-day I am anxious to have you write a good story. I shall write a subject on the board and I want you to tell me the most interesting story that you can. After you begin (and do not begin until I say ' Go ') you are not to consult the dictionary or ask questions of anyone, not even your teacher. After I write the subject on the board you may ask me questions for a few minutes."

Then the subject: "*How I would spend one hundred dollars to please five persons who like different things,*" was written on

[19] More extended directions and the complete list of subjects are given in the Appendix.

the board. Three to five minutes were allowed for questions which when answered gave a clear understanding of what was wanted. All others were eliminated.

The class was then started and allowed to write twenty-two minutes. At the end of that time the writing was stopped and this direction given: " You will now have a few minutes to look over your paper. Look through it carefully and make any corrections you wish without consulting anyone."

Three minutes were allowed for this and then the papers were collected and labelled as indicated in the directions under " Spelling."

TEST OF RANGE OF VOCABULARY[20]

Range of Vocabulary has been studied at some length by Hall,[21] Whipple,[22] and others. The tests used in this study are designed to determine range of vocabulary, and when the equality of the words has been determined, to be used as the basis for developing standardized methods for testing range of vocabulary of various kinds. It has not been possible to work out the equivalence of the words and accordingly only the gross scores are presented.

TEST I

These tests were administered as follows: The printed test papers for each of the tests were distributed face downward by the monitors. This direction was then given: "At the signal, ' Go,' turn over your paper, read carefully the directions at the top of the sheet and then do as quickly as possible exactly what it says to do."

The pupils were started on signal and allowed exactly three minutes. Names and dates of birth were then written upon the papers and the papers collected by the monitors.

TEST II

Directions and procedure identical with Test I.

[20] The author wishes to acknowledge his indebtedness to Professor E. L. Thorndike for the tests used in this section.

[21] Aspects of Child Life and Education, pp. 1-52.

[22] Manual of Mental and Physical Tests, 1910 edition, Chapter 12, with references.

TEST III

Directions and procedure identical with that in Tests I and II, except that five minutes was allowed.

ARITHMETIC

Even the casual reader of educational literature is impressed with the fact that an enormous amount of testing has been done in this field. The work of Rice, Stone, and Courtis is known to every one.[23] Aside from the commercial work of Mr. S. A. Courtis, a large number of publishing houses have recently issued new devices to aid in making a continuous test or survey of the arithmetic work of various grades of the elementary school. Many superintendents that are progressive have sought to improve these. For example, there was reported by Mr. J. T. Giles,[24] of Marion, Indiana, in 1911, a rather extensive series of experiments. A number of principals of the St. Louis schools have been at work for the last two years upon various forms of tests and methods of keeping records. Confronted with this mass of material it was difficult to decide what was best to use as a measure of arithmetical ability.

After a careful comparison of the results and methods of deriving tests, it was decided to select some of the Courtis Tests in view of the fact that 33,000 children had been given the Courtis Tests in New York City, during the progress of the New York School Inquiry.[25] Tests 1 to 5 were rejected because it is felt that Tests 1 to 4 do not measure arithmetical ability in each of the four fundamental processes and that Test 5 measures largely the speed at which figures can be written. Test 6, Speed Reasoning, is fairly good. Courtis himself reports that Test 8 is a very unsatisfactory test due to the fact that this test seems to involve difficulties which are inherent in the pupil's ability to read.

Test No. 7, however, does not seem to be open to any of these objections. It is a graded list of problems in fundamental operations. Our effort has been to make as careful a standard

[23] *Op. cit.*

[24] Report of the Department of Superintendence, 1912, St. Louis, Mo., p. 164.

[25] There is recognized much truth in the criticism of the method of deriving and applying standards used by Mr. Courtis (in this connection, see Bailey in Report of the Superintendent of Schools, City of New York, July 31, 1913, p. 505 ff), yet for the reasons stated in this section, it was impossible to derive an arithmetic scale.

measure as possible of the ability of the classes tested and since the Courtis tests are readily available, even if we deny the validity[26] of Mr. Courtis's method of determining the standards of Test No. 7, we have at hand distributions of 27,171 individual scores of Test 7, made by children in the schools of New York City. These facts make it evident that we have a standard test and in addition distributions that will assist us in further standardization. Limits of time would not permit the making of an arithmetic scale before beginning this work which was the only other course open. The method of administering this test was the same as that recommended by Courtis.[27]

Section 2

Other Data Collected at the Time the Tests Were Given

Upon leaving the class room when the tests were given, there were recorded upon the envelope in which the papers were collected, the following facts:

1. Name of city.
2. Building.
3. Grade.
4. Teacher.
5. Date of test.
6. Exact time of day the test was given.

For the purpose of determining for the various classes tested the class size for the preceding years, the average size of class in which the children had been taught was determined for the four preceding years, that due allowance might be made for the influence of class size in the grades preceding those in which the tests were given. The figure used in the column "size of class" is the average daily attendance.

In order to determine the facts for each subject recorded in the columns " hours in school per week," " hours spent in home study per week," and " total cost of instruction per week," data were collected at the time of the visits to the classrooms and by letter from the teachers and supervisors and summarized on the following forms:

[26] See article by B. R. Buckingham, *Journal of Educational Psychology*, April, 1914.

[27] Instruction book, 1913.

DAILY PROGRAM FOR EACH CLASS

.....*City* .....*School* .....*Grade* .....*Class*

Time	Monday	Tuesday	Wednesday	Thursday	Friday

Remarks:

.....

.....

AMOUNT OF TIME REQUIRED FOR HOME STUDY IN EACH CLASS IN MINUTES PER WEEK

.....*City.* .....*School*

Subject	5 B	5 A_1	5 A_2	7 B_1	7 B_2	7 A
Arithmetic						
Composition						
Spelling						
Penmanship						
Reading						

Note.—Fill in additional classes and give time in minutes per week for every class in which tests were given.

DATA FOR COST OF TEACHING

Subject	Name of Teacher	Annual Salary
Arithmetic		
Composition		
Spelling		
Penmanship		
Reading		

.....*City*

.....*Grade* .....*School*

1. In how many payments is the teacher's salary made ?
2. How many weeks of school does each payment represent ?
3. Please submit a complete calendar of your school year.

For the purpose of studying the relationship between promotion rate and class size the promotion rate for at least one term and in some instances for two terms and the corresponding class size were tabulated for each of the systems. Similarly the salary of each teacher was tabulated by class sizes. Detailed explanation of the relationship of these factors is made in Chapter V.

Something should be said about the method used in rating teachers. Each superintendent was asked to rate his teachers by relative position. Most superintendents were unable to make more than five groups; some made six. The superintendent was asked to rate all of the teachers in the system. By the method commonly used for changing marks for relative position into units of amount,[28] the value of each superintendent's rating was found in terms of its A. D. The figure presented in the table represents the difference between these values and the average. The figures in bold face type represent distances below the average; figures in other type represent distances above the average. Accordingly we are able to place the teachers in seven possible groups in terms of the ratings given in each system: At the average, first group above the average, second group above the average, third group above the average; first second and third groups below the average.

[28] For the technique used, see Mental and Social Measurements by Thorndike, 1913 edition, Chapter VIII.

Section 3

The Method of Scoring

SPELLING

In scoring the results in spelling, the twelve words given to each of the grades have been scored by the following method: The per cent of the pupils in the grade spelling each of the words correctly was determined. Since the words which were given are the words which are spelled correctly by approximately fifty per cent of the pupils in the grade on whose scale these words stand at the median, we have at once a measure of the status of a grade with reference to the grade standard in terms of the per cent of pupils who reach or exceed the median for the grade. As indicated in the table, the average of the per cents of the pupils spelling each of the standard words for a grade is taken as the status of the grade in spelling ability. The inter-grade comparisons[29] and inter-system comparisons are then made upon the basis of the per cent attained in terms of this standard.

WRITING

The method of scoring the handwriting is somewhat different from that followed in most studies. The handwriting has been scored both for quantity and for quality.

To determine the qualitative score samples of the writing taken from the speed test have been scored by the Thorndike Scale. For the details of this, the reader is referred to *Teachers College Record*, March, 1910, and the reprinted form issued in 1912. A large number of samples taken at the ordinary rate of writing when scored, made no essential difference in the status of the grade, so it was decided to use the scores for quality based upon samples taken from the speed test.[30]

In order to determine the quantitative grade, after a careful survey of the records made in grades V and VII, it was evident that the only qualities worth considering are qualities 9 and 10. The next problem to decide was, " What is the speed in letters per minute at which fifth grade children who are at median

[29] For details with regard to the measurement of spelling and the scales used, see Buckingham, *op. cit.*

[30] For the actual grading of the samples of handwriting and English composition the form of scale now published by Teachers College was used.

ability write respectively quality 9 and quality 10," and further, " What is the speed in letters per minute at which seventh grade children of median ability write qualities 9 and 10 ? "

Upon distributing the scores in letters per minute written by fifths and sevenths at various speeds for qualities 9 and 10, the following standards were adopted as representing most nearly the median ability of fifth grades and seventh grades for the systems tested. No claim is made that this is a final standard. It has proved to be an exceedingly useful tentative standard and may be used in the derivation of finer standards.

FIFTH GRADE.

Quality 9 at 65 letters per minute.
Quality 10 at 60 letters per minute.

SEVENTH GRADE.

Quality 9 at 95 letters per minute.
Quality 10 at 85 letters per minute.

The number of letters written per minute was determined by counting by means of a key sheet, which contained the passage written and the totals by line, stanza, and paragraph. The score was expressed as the rate in letters per minute. In the table of attainment presented in the succeeding chapter, the speed scores under each quality are in terms of the per cent of the total membership of each class that attains the speed standards for qualities 9 and 10 respectively for the particular grade considered.

ENGLISH COMPOSITION

The compositions were scored by the Hillegas Scale. In general the records for composition represent two independent scorings by this scale for each composition. For the details of the use of the scale, the reader is referred to the Measurement of Quality in English Composition by Young People, *Teachers College Record*, Vol. 13, No. 4, September, 1912.

RANGE OF VOCABULARY

The scores in this test were made upon the basis of the number of words correctly interpreted, number of words omitted and number of words wrongly interpreted. For the purposes of this

study, the achievement is measured in terms of the number of words correctly interpreted in Test III. It was impossible to use the records from Tests I and II for the reason that they are too easy for the seventh grades, and hence the records are not comparable to the records of the fifth grades. This is not the case for Test III and accordingly this test was used throughout the study. When reference is made to the attainment of a grade, it is to be understood that this attainment is the median attainment for number of words correctly interpreted.

ARITHMETIC

For the test in arithmetic, as stated above, Test 7 of Series A, Courtis Tests in Arithmetic was used. The method of scoring adopted is that described by Mr. Courtis. The scores were made in Attempts and Rights. For the purposes of this study, scores are presented in terms of the number of problems solved correctly or in the language of Mr. Courtis, " Rights." [31]

METHODS OF COMPUTATION

For the details of all methods of computation dealt with in the succeeding pages the reader is referred to Thorndike's " Mental and Social Measurements," 1913 edition. The methods of computation referred to in this chapter are sufficiently simple to be clear from the brief description given. For such a rather intricate computation[32] as the determination of the per cent of fifth grade children who reach or exceed the median of seventh grade children in ability to spell sixth grade standard words, acquaintance with Chapter XIII of Thorndike[33] is desirable.

[31] Instructions for scoring. Special Graph Sheet, Test 7, Series A, 1914.
[32] See Chapter III *infra*.
[33] *Op. cit.*

CHAPTER III

STANDARDS OF ACHIEVEMENT FOR FIFTH AND SEVENTH GRADE PUPILS

The scores made by the seventeen hundred twenty fifth and seventh grade pupils[1] have been distributed by sexes and by half grades[2] in order that we may determine so far as our data will permit the typical attainment for each half grade tested, and the amount of growth between grades five and seven and between half years of these grades. With the random sampling of pupils which has been explained in detail in Chapter II there are presented here a sufficient number of records to offer at least tentative standards.

The data are presented in the tables which show (1) the complete distributions of the scores made by half years, and (2) the amount of overlapping[3] by grades and half grades. So far as the form of distribution is concerned, it might be assumed throughout this study that ability in the subjects of spelling, handwriting, English composition, and arithmetic is distributed according to the normal surface of frequency. The tables offer considerable evidence for this assumption. Where the distribution is cut off, it indicates the relative difficulty of the tests for the different grades, since the same test material was used throughout. Buckingham[4] presents the argument for such a distribution of spelling ability, and since Buckingham's material is used in our spelling tests, this form of distribution

[1] Incomplete records of more than 200 children have led the author to present only 1,430 complete records for all the tests.

[2] In determining the half years in each of the grades, the first nineteen weeks of school is considered the first half year, and all time beyond the nineteenth week is considered a part of the second half year. Thus, if tests were given some time in the first nineteen weeks of school, the scores are recorded as having been made by children in the first half year.

[3] In general this overlapping is the per cent of pupils, who, irrespective of sex, reach or exceed the median of the seventh grade, second half year. In addition certain facts of overlapping within the grades and by sexes have been calculated.

[4] *Op. cit.*

has been assumed for spelling. The work of Ayres[5] suggests that measures of the legibility of handwriting are distributed approximately according to the normal surface of frequency. The distribution of scores of the Courtis test[6] indicates in general an approximation of the same form of distribution. For range of vocabulary the assumption of this form of distribution would not be fair because the relative difficulty of the words used in the tests has not yet been determined. Accordingly the only course open is to compare roughly the gross attainment by grades and half grades.

The imperfection of the scales[7] used does not warrant us in making final assumptions in regard to the form of distribution. Accordingly, no assumption is made for the traits other than spelling. But, as will be shown later, since the size of group[8] in which these records were taken has not exerted an appreciable influence upon the scores, we are justified in gathering the records of all the children tested in the different half grades into tables such as these. The measures used, such as the gain by sexes upon the median of the lowest grade, and the per cent of pupils of a grade that reaches or exceeds the median attainment for pupils of a higher grade, is in nowise affected by the form of distribution.

In examining the scores in the tables in this section, the student will note certain sex differences. These differences though large in several instances are not sufficient in amount for the subjects taken together to suggest separate provisions for the sexes. Until these are studied in connection with age differences, which was impossible in the limits of the present study, no conclusions of any validity can be advanced. But

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[5] A Scale for Measuring the Quality of Handwriting of School Children.

[6] Final Report of the Committee on School Inquiry for New York City, 1911-1913, Vol. I, pp. 385-546. Revised Graph Sheets for Test No. 7, 1914.

[7] It should be stated very frankly that these tests do not enable us to make an accurate scale of ability in arithmetic, spelling, composition, or any of the other traits. All careful work in psychology shows that it is one thing to improve in ability from four to five on the Courtis scale and quite another thing to improve from eight to nine on the same scale. It is one thing to improve handwriting in quality from eight to nine on the Thorndike scale and a very different thing to improve handwriting from eleven to twelve on the same scale.

[8] The fact that the size of group has not exerted any influence upon the attainment is of great importance in considering the data for standardizing purposes. Since the data are not affected by the size of group in which the tests were made they gain added significance as tentative standards.

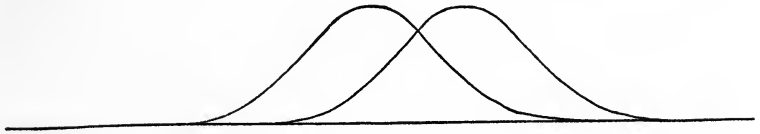

FIG. 1. The amount of difference between grades V-B and VII-A when the per cent of pupils in the V-B grade reaching or exceeding the median of VII-A is 7.10.

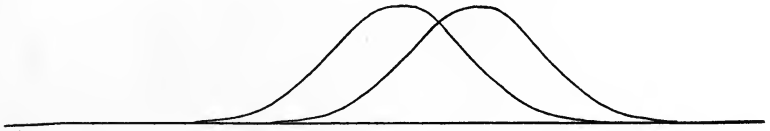

FIG. 2. The amount of difference between grades V-A and VII-A when the per cent of pupils in the V-A grade reaching or exceeding the median of VII-A is 12.5.

FIG. 3. The amount of difference between grades V-A and VII-A when the per cent of pupils in the V-A grade reaching or exceeding the median of VII-A is 19.0.

we have here a body of data by sexes which is of value for comparative and standardizing purposes.

By overlapping is meant the per cent of pupils in the fifth grades which reaches or exceeds the median attainment of the seventh grade, or the per cent of pupils in a lower fifth grade which reaches or exceeds the median of pupils in an upper fifth grade. An examination of the general tables reveals the fact that there is a large amount of overlapping in the grades. With overlapping defined in this manner, it does not mean that where there is no overlapping portions of the surfaces of frequency do not enclose common areas. The central tendencies and variabilities show that they do.

In the tables and diagrams which present the studies in overlapping, the reader will note that in each of the subjects the amounts of overlapping indicate the amount by which the half grades and full grades differ from each other, and as such are symptomatic of the amount of growth between these grades. To be most valuable, such amounts of growth should be checked by studies extending over several years, in order that we might have the data by which to standardize amounts of growth that should be required in the various grades. Such should be extended also to include all of the subjects. As stated in a previous section, one of the most important contributions sought in this study is the derivation of a standardized method by which such studies may be carried on continuously in any school system.

The striking thing in these results is that the half years of the seventh are very much closer together in all of the subjects than the half years of the fifth grade.[9] In arithmetic there are rather typical amounts of overlapping so far as the fifth grades are concerned. In English composition comparatively few students reach or exceed the median for the upper seventh grade, and here we find the seventh grades closer together than the fifths.

In handwriting we have the very peculiar situation of very little overlapping. The central tendencies and variabilities are

[9] The amounts of overlapping were obtained by computing from the complete tables of distribution, the per cent of students by sexes, which reaches or exceeds the median selected as a standard. In general, for these per cents, the median of the upper seventh grade has been selected, although other significant amounts of overlapping are presented.

so nearly equal that so far as these systems are concerned, we are forced to the conclusion that the tendency seems to be to have children write as early as the fifth grade, at a quality between 9 and 10, and that not much higher attainment is required in the other grades. As has been suggested above, it has not been possible to study the amounts of overlapping for range of vocabulary, as we know nothing about the relative difficulty of the words used. For the same reason, it is not possible to study the amount of overlapping for handwriting, measured quantitatively, because in the absence of experimental determinations we cannot state a standard which is comparable with the other standards used in this study. Where the scores for quantity are used, they are to be considered as gross scores on the basis of the tentative standards suggested in Chapter II.

What is presented in this and succeeding sections is offered with the hope that the method of investigation will prove suggestive, and that the various tables may be used as tentative standards by which to work out more elaborate ones, and to determine what the amounts of overlapping in the various grades should be. In common with most of the recent studies of this character, the amounts of overlapping are exceedingly variable. This indicates, of course, that individual variation among pupils is certainly not provided for in any intelligent manner. The amounts of overlapping of the sexes while not suggesting the necessity for separate treatment, do at least suggest an important problem. These results are typical and represent typical ranges of attainment for American city systems, in so far as the systems tested are typical of conditions in the United States. Every care has been taken to include different population groups, different standards of teaching, and the like, as has been explained in detail in the previous section.[10]

[10] Discussion of the tables and graphs has not been offered at length. The tables and illustrations summarize the results in form for convenient use. Complete tables of the results are not printed because the cost is prohibitive.

TABLE I

ARITHMETIC—COURTIS TEST No. 7

Scale	Fifth Grade First Half			Fifth Grade Second Half			Seventh Grade First Half			Seventh Grade Second Half		
	B.	G.	Total	B.	G.	Total	B.	G.	Total	B.	G.	Total
0	6	2	8	19	15	34	1	....	1	1	3	4
1	11	9	20	22	19	41	1	....	1	4	4	8
2	15	17	32	25	27	52	1	3	4	2	7	9
3	24	20	44	32	39	71	7	2	9	16	16	32
4	15	17	32	38	35	73	14	10	24	15	13	28
5	18	13	31	37	31	68	13	3	16	14	17	31
6	6	5	11	31	18	49	20	12	32	24	24	48
7	3	6	9	38	21	59	19	10	29	32	24	56
8	1	4	5	29	18	47	12	15	27	31	20	51
9	3	3	6	15	7	22	8	12	20	26	22	48
10	....	....	.....	5	....	5	7	4	11	7	13	20
11	....	....	.....	4	1	5	7	6	13	12	10	22
12	....	....	.....	....	....	.....	2	7	9	4	2	6
13	....	....	.....	....	....	.....	....	3	3	6	3	9
14	....	....	.....	1	....	1	1	1	2	3	3	6
15	....	....	.....	....	....	.....	....	1	1	3	3	6
16	....	....	.....	....	....	.....	....	2	2	1	....	1
17	....	....	.....	....	....	.....	....	1	1	....	....	.....
18	....	....	.....	....	....	.....	....	....	.....	....	....	.....
19	....	....	.....	....	....	.....	....	....	.....	....	....	.....
Average..	3.98	4.32	4.15	5.34	4.65	5.04	7.15	8.41	7.80	7.80	7.37	7.59
A. D.....	1.51	1.52	1.65	2.24	1.99	2.08	2.15	2.48	2.33	2.33	2.46	2.40

Summary of Results by Grades, Half Grades and Sex for Each of the Tests. Amounts of Growth by Half Grades and Sex

ARITHMETIC

In arithmetic, measured by results obtained in Test No. 7 of the Courtis tests, the girls are superior to the boys in the first half of the fifth year and the first half of the seventh year, but the boys are superior in the second half of each of these grades by the amounts which follow. Measured by the per cent of all pupils in the half grades that reaches or exceeds the median of Grade VII-A the amounts are as follows:

Grade V-B	Grade V-A	Grade VII-B
7.1%	19.0%	48.0%

If we consider the influence of sex the following per cents of boys reach or exceed the median for girls in each half grade:

Grade V-B	Grade V-A	Grade VII-B	Grade VII-A
36.3%	60.5%	28.3%	55.7%

From an examination of the table of results, it is seen that there is growth in median attainment throughout the grades for boys. For girls there is little growth between half years of grade five and the girls of the first half of grade seven are superior to the girls of the second half of this grade. A careful examination of the sources of the data indicates that this superiority is not the result of a selection from the best systems.[11] On the contrary, what would be regarded as the poorest school population is included in this set of records. In the fifth grade, the boys show a growth on their median ability for the first

[11] In general the standards for the testing of work in the various classes examined are not radically different. The classes of System D are examined more particularly than those of other systems to determine the amount of growth in attainment in a certain period. It is almost impossible to estimate the amount of influence which this requirement would have as compared with the amount of influence which the usual requirement that children meet the standards of the tests set by the supervisory officers at various intervals exerts. From a careful discussion of this subject with the supervisory officers in the various systems, the writer has been unable to determine any difference in the effect upon teachers or the attainment of classes. The results obtained in the classes in System D do not indicate the operation of a superior force. Since all of the systems offer examinations set by the supervisory force, the amount of influence which the particular "system" of examinations exerts may be regarded as negligible so far as the results reported in this study are concerned.

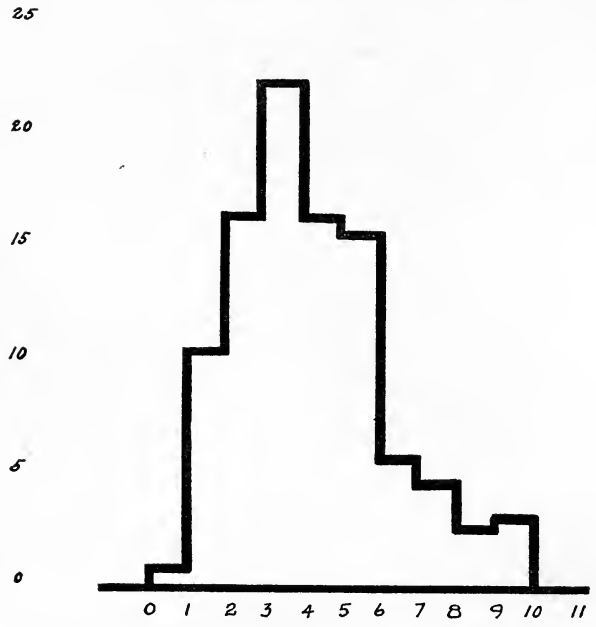

FIG. 4. TYPICAL DISTRIBUTION. ARITHMETIC. GRADE V-B (BOYS AND GIRLS).
The frequencies are expressed as per cents of the pupils in this grade; 7.10 per cent reaches or exceeds the median for grade VII-A.

half year of the grade, of 1.36 or 34.2 per cent. In the seventh grade they show a gain of .65 on their median ability or 9.9 per cent. The differences for girls are as noted above. For the sexes taken together, the gain in the second half of the fifth year on median attainment of the first half year is .89 or 21.4 per cent. For boys and girls throughout the grades, the gains on their median attainment for the first half year of the fifth grade are shown in the following table:

ARITHMETIC

Grade	Boys		Girls		Both Sexes	
	Attainment	Gain	Attainment	Gain	Attainment	Gain
Grade V-B.....	3.98	....	4.32	....	4.15	....
Grade V-A.....	5.34	1.36	4.65	.33	5.04	.89
Grade VII-B.....	7.15	3.17	8.41	4.09	7.80	3.65
Grade VII-A.....	7.80	3.82	7.37	3.05	7.59	3.44

TABLE II

ENGLISH COMPOSITION

Hillegas Scale	Fifth Grade First Half			Fifth Grade Second Half			Seventh Grade First Half			Seventh Grade Second Half		
	B.	G.	Total	B.	G.	Total	B.	G.	Total	B.	G.	Total
0	37	22	59	.....	.....	.....	2	1	3	.....	.....	.....
30	11	2	13	6	1	7	.....	.....	.....	.....	.....	.....
60	43	37	80	10	8	18	1	.....	1	1	.....	1
120	45	40	85	25	15	40	6	.....	6	.....	.....	.....
183	75	81	156	27	6	33	41	35	76	3	.....	3
222	34	45	79	22	3	25	76	39	115	24	9	33
260	24	23	47	25	11	36	45	46	91	15	5	20
315	4	20	24	13	5	18	46	47	93	7	5	12
369	2	5	7	.....	6	6	17	39	56	4	1	5
422	3	1	4	.....	.....	.....	8	25	33	2	7	9
474	.....	.....	.....	.....	.....	.....	11	15	26	7	9	16
530	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	7	10
585	.....	1	1	.....	.....	.....	.....	1	1	2	1	3
630	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1
675	.....	.....	.....	.....	.....	.....	1	.....	1	.....	1	1
Median....	183.5	201.3	218.5	217.7	209.0	215.0	262.5	319.5	290.8	285.7	444.3	319.5
Q	65.8	56.95	61.57	56.5	85.6	64.6	54.5	75.8	64.5	74.61	115.63	116.27

The growths through the grades by sexes and by pupils, irrespective of sex, are shown in the table of overlapping. These facts are also illustrated in the diagrams. These amounts of growth may be taken as typical for cities similar to the ones tested. The very striking thing, of course, is the fact that the half years of the seventh grade are practically together, whereas there are distinct differences between half years of the fifth grade, and between the fifth and seventh grades.

These amounts of growth would be further illuminated by a study of growths within the different grades over various periods of time. It is impossible to present measures of this kind within the limits of the present study, although these data are being collected for a large number of the same children whose records are included in this report. This matter has been studied somewhat by Courtis[12] and Rall.[13] The median attainment from tests made in New York City in 1912 by Mr. Courtis was, for 5836 children of the fifth grade 5.8, and for 4771 seventh grade children 8.5. The amount of growth measured

[12] First and Second Annual Accountings.

[13] *School Review Monograph*, No. 3, Feb., 1913, pp. 36-45.

by median attainment is 1.7 or 30 per cent.[14] In the recent publication of diagrams based upon the scores of 2000 classes in the cities of New York, Boston, Detroit, and similar cities in fifteen states,[15] the average attainment for grade five is given as 4.7 and for grade seven as 7.7. The amount of difference in average attainment is three "rights." These amounts, however, are not as valuable as the records in this section, because the medians represent a figure taken from the scores of children indiscriminately mixed as to sex, age, and half grades.

COMPOSITION

The tabulated results in Table II show growth throughout the half years for boys and for girls. The same is true for the sexes considered together, although there is practically no difference between the attainment of the first and second half years of the seventh grade. The amounts of growth in terms of the median for the first half of the fifth grade are as follows:

ENGLISH COMPOSITION

Grade	Boys		Girls		Both Sexes	
	Attainment	Gain	Attainment	Gain	Attainment	Gain
Grade V-B.....	183.5	.....	201.3	.....	218.5	.....
Grade V-A.....	217.7	34.2	209.0	7.7	215.0	—3.50
Grade VII-B.....	262.5	79.0	319.5	118.2	290.8	72.3
Grade VII-A.....	285.7	102.2	444.3	243.0	319.5	101.0

Measured by the per cent of all pupils in the half grades that reaches or exceeds the median attainment of Grade VII-A, the amounts of overlapping are as follows:

Grade V-B	Grade V-A	Grade VII-B
6.1%	12.8%	40.3%

Sex differences are prominent in this trait also. The per cents of boys reaching or exceeding the median attainment for girls in each half grade are as follows:

Grade V-B	Grade V-A	Grade VII-B	Grade VII-A
38.4%	54.0%	31.7%	21.7%

[14] Final Report of the Committee on School Inquiry for New York City, 1911-1913, Vol. I, p. 434.

[15] Revised Graph Sheet for Test No. 7, Series A, 1914.

SPELLING

The scores made for the words by grade gain added interest if compared with the findings of Dr. Buckingham. For the benefit of the reader, I quote the following results from Buckingham[16]:

Word	Lower Grade %	At Grade %	Higher Grade %
Fourth Grade			
Wear	35	49	61
Button	32	52	61
Touch	45	52	60
Surface	....	48.4	79.1
Fifth Grade			
Believe	37.2	49.7	64.4
Loose	24.7	49.1	45.2
Circus	39	50	72
Carriage	40	50	67
Sixth Grade			
Saucy	40	52	71
Whistling	40	49	68.7
Beginning	37	46	66
Succeed	....	53	70.8
Seventh Grade			
Ascending	37.6	52	55.7
Slipped	42.9	51.8	70.9
Imagine	33.6	47.7	66.4
Character	40.2	47.1	78.7
Eighth Grade			
Peculiar	46.3	56.1	....
Mixture	91	97.1	....
Intelligent	43.6	50.4	....
Occasion	44.4	49.6	....

We find the girls superior to the boys in all of the grades, although the differences as has been suggested before, are not sufficiently significant to suggest different provisions for the sexes. There is a rather uniform growth throughout the grades for boys, and a somewhat less uniform growth for girls. The girls in the second half of the fifth grade are practically equal to the boys, and but slightly inferior to the girls of the first half of the seventh grade. For the sexes considered together, there is a growth throughout the grades. In computing the amount of growth from Grade V to Grade VII it would be possible and valid to compute the amount of overlapping of

[16]Spelling Ability, Its Measurement and Distribution, pp. 14-15, 78-79 104-105.

TABLE III. SPELLING

FIFTH GRADES. SYSTEMS A TO G, INCLUSIVE

	First Half Year						Second Half Year					
	Boys		Girls		Both Sexes		Boys		Girls		Both Sexes	
	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right
Wear	170	62.5	212	70.0	382	65.6	98	70.5	31	81.6	129	72.9
Button	157	58.0	195	63.0	352	60.5	92	66.2	27	71.1	119	67.2
Touch	121	44.5	162	52.0	283	48.5	74	53.2	21	55.3	95	53.7
Surface	152	56.0	195	63.0	347	59.6	100	71.9	34	89.5	134	75.7
Believe	112	41.2	163	52.6	275	47.2	73	52.5	31	81.6	104	58.6
Loose	129	47.4	170	54.8	299	51.4	53	38.2	20	52.6	73	40.7
Circus	103	37.8	147	47.4	250	43.0	75	53.9	27	71.1	102	57.6
Carriage	75	27.6	120	38.7	195	33.5	69	49.6	29	76.3	98	55.4
Saucy	89	32.7	125	40.3	214	36.8	76	54.7	31	81.6	107	60.5
Whistling	53	19.5	67	21.6	120	20.6	62	44.6	21	55.3	83	46.9
Beginning	82	30.2	112	36.1	194	33.3	49	35.3	19	50.0	68	38.4
Succeed	97	35.7	133	42.9	230	39.5	52	37.4	21	55.3	73	40.6
Total Number	272		310		582		139		38		177	

TABLE III. SPELLING—*Continued*

SEVENTH GRADES. SYSTEMS A TO G, INCLUSIVE

	First Half Year						Second Half Year					
	Boys		Girls		Both Sexes		Boys		Girls		Both Sexes	
	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right	Number Right	Per Cent Right
Saucy	162	62.5	166	72.2	328	67.1	52	75.3	39	86.7	91	79.8
Whistling	145	57.5	141	61.3	286	58.5	50	72.5	31	68.9	81	71.0
Beginning	163	62.9	164	71.3	327	66.8	42	60.9	33	73.3	75	65.8
Succeed	165	63.7	151	65.7	316	64.8	54	78.3	37	82.2	91	79.8
Ascending	116	44.8	111	48.3	227	46.4	56	81.2	39	86.7	95	83.3
Slipped	139	53.7	126	54.8	265	54.2	49	71.0	37	82.2	86	75.4
Imagine	110	42.5	129	56.1	239	48.9	47	68.1	32	71.1	79	69.3
Character	143	55.2	150	65.2	293	59.9	46	66.7	33	73.3	79	69.3
Peculiar	153	59.1	143	62.4	296	60.5	46	66.7	29	64.4	75	65.8
Mixture	195	75.3	166	72.2	361	73.6	59	85.5	41	91.1	100	96.5
Intelligent	114	44.0	140	60.9	254	51.9	36	52.2	23	51.1	59	51.7
Occasion	149	57.5	148	64.3	297	60.7	38	55.1	26	57.8	64	56.1
Total Number	259		230		489		69		45		114	

the grades in terms of the four words common to the two lists (i.e., sixth grade standard words spelled by 50 per cent of the pupils) by reference to the normal surface of frequency. Or the amounts of growth from grade to grade may be computed from Buckingham's scale. The latter method is more precise because it enables us to use all of the words in each list and has been adopted.

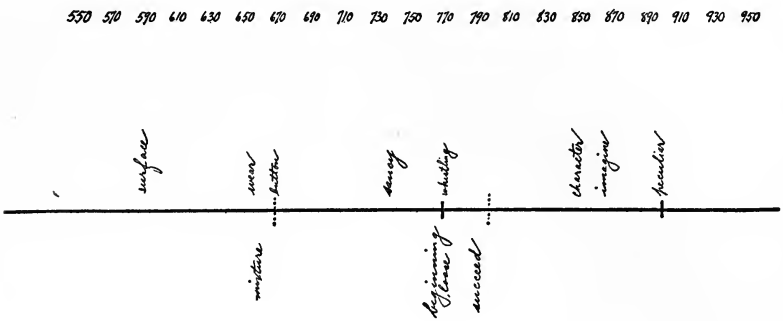

FIG. 5

The method is illustrated in Figure 5. The figures above the line represent spelling ability measured from zero. The method briefly is this: Four words were selected from the list given to Grade VII-A, which are spelled roughly by 69 per cent of the pupils and their position on the scale marked. Using this figure as the standard, the four words spelled by this per cent of pupils were selected from the list for each half grade and their position marked on the scale. Allowance should be made for the fact that the various words are not spelled by exactly 69 per cent of the pupils in the various grades. The correction is small in most instances and would not affect the inferences which are drawn in this section, so no elaborate method of rescaling has been adopted in the diagram.

The writer has also scaled carefully each of the twelve words for each half grade by precisely the same method which Buckingham used in the construction of his scales. (See especially pages 61 and 116 of "Spelling Ability," *op. cit.*) This does not modify any conclusions with respect to the amount of growth between grades five and seven that may be drawn from the relative position of the words as they stand upon Buckingham's scale. (The diagram represents the position as determined by

Buckingham, not the position which would be assigned by sixty-nine per cent.) The amount of growth from grade five to grade seven, giving weights of five and two respectively to the records of the first and second half years is 1.007 P. E. or roughly about 100 units on Buckingham's scale. The amounts of growth for the separate grades are as follows: Grade V-B to Grade V-A, forty-four units; Grade VII-B to Grade VII-A, fifty-two units.

WRITING

It is impossible to present standards or amounts of growth for these grades in handwriting, either for quality or quantity which may be taken as final. However, we do have growth from grade to grade with some peculiar deviations if we consider the sexes separately. For quality the gains are shown below:

HANDWRITING

Grade	Boys		Girls		Both Sexes	
	Attainment	Gain Amt.	Attainment	Gain Amt.	Attainment	Gain Amt.
Grade V-B.....	9.40	....	9.90	....	9.62	....
Grade V-A.....	9.95	.55	10.67	.77	10.15	.53
Grade VII-B.....	9.85	.45	10.56	.66	10.25	.63
Grade VII-A.....	10.50	1.10	11.42	1.52	10.77	1.15

As explained in Chapter II, the distribution of the various speeds for qualities nine and ten for the various half grades shows that the only tentative standards that could be considered are as follows:

Grade five:

Quality nine at 65 letters per minute.

Quality ten at 60 letters per minute.

Grade seven:

Quality nine at 95 letters per minute.

Quality ten at 85 letters per minute.

These may not be regarded as more than tentative standards until experimental determinations are made of the growth in power to write at various speeds and qualities as children progress through the grades. In the absence of this evidence they are serviceable in that they give us a rough index of the growth in speed at the same quality.

TABLE IV. RANGE OF VOCABULARY. TEST III

No. of Words Correctly Recognized	Fifth Grade First Half			Fifth Grade Second Half			Seventh Grade First Half			Seventh Grade Second Half		
	B.	G.	Total	B.	G.	Total	B.	G.	Total	B.	G.	Total
0– 4	6	4	10	17	4	21	5	1	6	3	0	3
5– 9	5	3	8	9	4	13	9	0	9	1	0	1
10–14	8	2	10	4	6	10	4	0	4	1	0	1
15–19	19	4	23	15	5	20	1	0	1	1	0	1
20–24	10	14	24	17	10	27	2	1	3	0	0	0
25–29	16	14	30	28	8	36	2	0	2	4	1	5
30–34	17	21	38	21	18	39	5	3	8	7	1	8
35–39	18	24	42	17	22	39	4	3	7	3	3	6
40–44	11	26	37	24	15	39	4	7	11	4	2	6
45–49	13	14	27	28	20	48	11	4	15	8	10	18
50–54	8	12	20	25	20	45	8	7	15	16	17	33
55–59	6	14	20	18	20	38	17	13	30	19	28	47
60–64	9	6	15	17	8	25	25	19	44	58	58	116
65–69	3	0	3	2	6	8	13	11	24	67	50	117
70–71	2	0	2	0	0	0	1	1	2	23	16	39
Median...	33.5	38.5	36.4	38.3	42.3	40.0	55.3	58.9	56.7	63.6	62.8	63.1

TABLE V. HANDWRITING

Thorndike Scale	Fifth Grade First Half			Fifth Grade Second Half			Seventh Grade First Half			Seventh Grade Second Half		
	B.	G.	Total	B.	G.	Total	B.	G.	Total	B.	G.	Total
4	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	4	1	5	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	4	1	5	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	6	.....	6	1	.....	1	4	.....	4	.....	.....	.....
8	60	36	96	5	.....	5	24	4	28	1	.....	1
9	121	106	227	71	23	94	111	35	146	27	10	37
10	40	103	143	48	21	69	78	122	200	36	12	48
11	5	9	14	12	13	25	18	40	58	15	19	34
12	1	4	5	7	5	12	5	8	13	5	11	16
13	1	3	4	2	6	8	2	4	6	5	4	9
14	1	1	2	1	1	2	1	1	2	.....	1	1
15	.....	1	1	1	2	3	.....	.....	.....	.....	1	1
16	.....	1	1	.....	1	1	.....	.....	.....	1	1	2
17	.....	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....
Median.....	9.4	9.9	9.62	9.95	10.67	10.15	9.85	10.56	10.25	10.50	11.4	10.77
Q.....	.575	.64	.68	.637	.97	.837	.63	.45	.63	.72	.95	.88

RANGE OF VOCABULARY[17]

For the reasons explained at length in the preceding sections, it is impossible to present measurements of growth, either by per cent of improvement on the median scores, or by the amount of overlapping, because of the inequality of the words used in the tests. The complete tabulations of the achievements of the pupils in this test by grades and sexes, furnishes a convenient table of reference for the use of those investigators who desire to repeat the test, and the following summary gives in convenient form an index of the growth in range of vocabulary from grade to grade if it is interpreted with the caution suggested above.

RANGE OF VOCABULARY

Grade	Boys		Girls		Both Sexes	
	Attainment	Gain Amt.	Attainment	Gain Amt.	Attainment	Gain Amt.
Grade V-B.....	33.50	.....	38.50	.....	36.40	.....
Grade V-A.....	38.30	4.80	42.30	3.80	40.00	3.60
Grade VII-B.....	55.30	21.80	58.90	20.40	56.70	20.30
Grade VII-A.....	63.60	30.10	62.80	24.30	63.10	26.70

[17] It should be stated frankly that the author recognizes the fact that possibly the best method of determining range of vocabulary has not been used. If we wish to obtain the true range it could probably be done better by giving the student all the time he needs to mark the words he knows. On the other hand, if we wish to obtain his range in a definite time it would be advisable to set a time limit. However, it may be said in defense of the "mixed method" used that fairly good seventh grade pupils were able to recognize in the time allotted, five minutes, all of the words which they know in Test III.

CHAPTER IV

ATTAINMENT IN CLASSES

Possible Uses of the Scores of Attainment and Related Facts

In this chapter there are presented complete tables which summarize the achievements of all of the fifth and seventh grade pupils by classes. Measurements of attainment and variability are given for each class. Other data presented give us a sampling of the following facts: Size of class, size of class in which the children have been taught for four years previous to the current school year, the annual salary of each teacher, the number of hours per week devoted to each subject in school, the number of hours per week devoted to each subject in home study, the total cost of instruction per week in each subject, and the date of the test.

The sufficiency of the data has been discussed in detail in Chapter II. So far as the grades and systems tested are typical of American cities, in addition to giving data on size of class in relation to these factors, the table furnishes typical limits of attainment for the various subjects tested.[1] It also offers in the form of a summarized random sampling from many classes, suggestive limits in time allotment for these subjects[2] in school and requirements for home study. Other facts given in the table may be utilized in making detailed analytical comparisons as has been done in the succeeding pages only for attainment, variability and amounts of overlapping.

In Chapter V is given a table of overlapping. This table has been computed somewhat more in detail than the ones given in Chapter III for all the scores taken together. Overlapping by

[1] With the exception of English composition. By utilizing more judgments than it was possible to do in the present study, the gross attainment would be slightly higher but the relationships among the grades would be unchanged.

[2] Cf. studies of time allotment by Stone in Arithmetical Abilities, Payne in Public Elementary School Curricula, Elson in N. E. A. Report, 1911, *op. cit.*

grades and half grades, and by small and large classes, is given for arithmetic, composition, and spelling.

In the following discussion, attainment of a grade is to be understood as the median attainment for the grade. The variation, unless otherwise stated, is expressed in terms of Q. Careful analysis of the scores for attainment in the various traits and the amounts of variability in Table VI does not reveal any correlation between these facts and the size of group in which the measurements were taken. But the data exhibit over and over the influence of growth in ability and indicate the value of the tests for measuring amounts of growth.

Detailed study of the table shows that the differences in amount in all the traits are closely related to amounts of growth. Such variations as appear in the scores that are taken in the same week of school in the various systems are such as are common in measurements with relatively rough scales of school traits such as these. Let us make a sample analysis of the scores of the seventh grade in arithmetic for a number of systems to illustrate the point.

In System D, in the second week of school we have a score of 7.9 in a class of twenty-six; a score of 6.4 in a class of twenty-nine; a score of 8.1 in a class of thirty-two, and a score of 8.4 in a class of thirty-four. The highest scores appear in the classes above thirty. The next to the highest score is found in a class of twenty-six and the lowest score in a class of twenty-nine. Again, there seems to be no correlation between the size of class and the attainment. In System E, classes of thirty-three and twenty-six, measured in the twenty-fifth week of school, make respectively scores of 8.65 and 9.29; the class of twenty-eight tested in the sixth week of school makes a score of 7.54; the better score is made in the smaller class. However, the difference between these scores is not nearly as great as the smallest difference between the class half a year behind these. This evidence of nineteen weeks of growth,[3] more potent than any influence of class size, is abundantly confirmed by the attainments in English composition, writing measured for quality, spelling and range of vocabulary. In System F we do do not have any evidence of the influence of class size or any

[3] These amounts of growth are comparable to those cited by Rall, *School Review Monograph*, No. 3, Feb., 1913. See also Courtis Graph Sheets for Test, No. 7, 1914.

significant measures of growth. There are other contributing factors which further study should take into account.[4]

In System G, we have a class of thirty-nine in the ninth week of school making a score of 6.91 and a class of thirty-two in the twenty-eighth week of school making a score 36.5 per cent higher. In the light of the evidence of growth cited above and the inter-system comparisons of growth, it is not conceivable that the reduction in membership of the class is sufficient to account for the larger score. Nineteen weeks of growth of the children is a far more logical and scientific explanation in the light of all of the facts cited in the discussions of this and succeeding sections.

The author has patiently made the same analysis for every trait and its variability for every class. The same evidence of growth and close correlation with attainment is present. Let us repeat: These classes are a wide selection from many more classes and care has been taken to get the smallest, middle sized, and largest classes in the fifth and seventh grades of the systems measured. Consequently the potency of the factors of growth, size of group, and the like readily becomes evident.

[4] The most probable cause here is the character of the population.

TABLE VI

CITY	TEACHER	RATING	GRADE	ANNUAL SALARY	SIZE OF CLASS	AVERAGE SIZE OF CLASS 4 YRS.	SPELLING			HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST
							LOWER GRADE	AT GRADE	HIGHER GRADE				
A	1	.42	5	575	31	42	39.0	24.4	11.25	1.17	2.5	.82	11
A	2	.42	5	550	33	42	57.4	38.9	26.4	1.15	1.25	.78	11
A	3	**2.58**	5	450	37	42	56.0	34.4	31.3	1.16	1.67	.61	11
A	4	.42	5	600	40	42	42.8	20.6	16.5	1.58	1.67	1.08	11
A	5	**.58**	5	625	42	42	65.3	44.0	42.6	1.17	.83	.84	11
A	6	**.58**	5	525	43	42	65.0	46.0	31.6	1.58	.67	.95	11
A	7	.42	7	550	35	46	70.5	51.0	62.4	.70	.67	.66	11
A	8	1.42	7	750	43	46	47.5	35.9	50.0	.75	.67	.54	11
A	9	.42	7	675	45	46	56.6	45.0	55.6	.75	.42	.61	11
A	10	1.42	7	600	46	46	78.2	52.1	68.2	.70	.75	.50	11
B	11	.42	5	450	30	46	70.3	51.4	56.1	1.17	1.67	.59	11
B	12	**.58**	5	625	44	46	59.7	39.5	31.9	1.40	1.25	1.00	11
B	13	.42	7	750	41	44	71.8	58.3	64.4	1.00	.50	.78	11
B	14	.42	7	550	42	44	63.1	45.6	51.2	.95	.50	.79	11
C	15	**.58**	5	625	30	47	60.0	53.3	33.8	1.17	2.5	.84	11
C	16	.42	5	550	38	47	45.5	33.7	28.0	1.17	1.67	.74	11
C	17	1.42	7	750	39	42	56.7	28.1	54.2	.82	2.3	.72	11
D	18	.88	5	775	15	34	88.0	88.0	64.0	1.5	1.25	1.30	20
D	19	**.12**	5	900	23	34	41.0	48.0	35.0	1.0	1.25	1.00	15
D	20	.88	5	800	27	34	66.0	61.0	44.0	1.25	0.0	1.11	15

TABLE VI—*Continued*

CITY	TEACHER	RATING	GRADE	ANNUAL SALARY	SIZE OF CLASS	AVERAGE SIZE OF CLASS 4 YRS.	SPELLING			HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST
							LOWER GRADE	AT GRADE	HIGHER GRADE				
D	21	**.12**	5	850	28	34	66.0	56.0	32.0	1.25	0.0	1.18	15
D	22	**.12**	5	800	36	34	61.0	65.0	40.0	2.0	0.0	1.65	15
D	23	**.12**	7	850	26	34	56.0	60.0	61.0	1.25	1.67	1.23	15
D	24	**.12**	7	950	29	31	51.0	35.0	54.0	1.33	0.0	1.51	15
D	25	**1.12**	7	1000	32	31	68.0	77.0	80.0	1.33	0.0	1.52	15
D	26	.88	7	975	34	31	59.0	60.0	68.0	1.25	1.25	1.49	15
E	27	.16	5B	800	40	37	70.6	49.3	47.8	1.67	1.67	1.61	6
E	28	1.16	5A	800	36	37	69.5	48.6	53.2	1.67	.83	1.57	25
E	29	1.16	5A	800	38	37	60.9	61.4	52.2	1.67	.25	1.53	25
E	30	.16	7B	750	28	29	79.0	71.0	74.0	1.67	1.0	1.51	6
E	31	.16	7A	800	33	29	79.0	74.4	66.2	1.92	1.0	1.84	25
E	32	**.84**	7A	800	26	29	70.7	81.6	65.2	1.25	.25	1.15	25
F	33	**.97**	5B	1110	45	40	59.7	51.2	32.7	2.50	.83	2.86	6
F	34	1.03	5A	1020	48	40	60.1	39.8	24.8	2.5	.83	2.63	25
F	35	.03	7B	1840	34	43	82.7	81.0	77.9	1.25	.83	2.38	6
F	36	1.03	7A	1420	37	43	76.7	62.5	64.2	1.25	.50	1.83	25
G	37	.30	$5A_1$	1500	38	40	78.0	56.5	44.9	.83	.42	1.27	25
G	38	**.70**	$5A_2$	720	39	40	67.9	47.4	47.4	.83	1.25	.61	25
G	39	.30	7B	1440	39	38	54.8	52.0	55.5	1.33	.50	2.46	6
G	40	.30	7A	1820	32	38	69.2	73.3	65.8	1.33	.33	2.49	25

TABLE VI—*Continued*

CITY	TEACHER	GRADE	COMPOSITION						ARITHMETIC					
			ATTAINMENT	VARIABILITY	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST	ATTAINMENT	VARIABILITY	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST
A	1	5	213.3	61.8	2.67	0.00	1.86	12	2.8	1.29	4.17	.83	2.91	24
A	2	5	200.3	48.8	2.73	0.00	1.88	12	3.61	2.13	2.73	0.00	1.88	24
A	3	5	234.7	32.2	2.92	0.00	1.50	12	5.53	1.73	4.10	.50	2.11	24
A	4	5	138.0	64.5	2.83	0.00	1.94	12	3.42	1.40	4.10	0.00	2.79	24
A	5	5	187.8	53.2	2.42	0.00	1.72	12	5.56	2.39	4.83	0.00	3.43	24
A	6	5	179.1	27.6	3.75	.50	2.27	12	4.27	1.87	2.5	.67	1.51	24
A	7	7	308.1	87.4	1.28	.67	1.23	12	5.24	1.59	3.28	3.33	2.17	24
A	8	7	287.5	108.0	1.33	.75	.96	12	4.15	1.94	3.33	0.00	2.70	24
A	9	7	392.6	50.6	1.33	.67	1.28	12	5.36	2.10	3.33	0.00	2.70	24
A	10	7	379.6	37.6	1.28	.50	.92	12	7.03	1.54	3.28	.67	4.26	24
B	11	5	176.7	25.8	2.75	0.0	1.39	12	5.53	1.73	5.33	0.00	2.69	24
B	12	5	215.0	12.5	2.93	0.0	2.08	12	4.19	1.76	3.92	.83	2.80	24
B	13	7	357.4	38.1	1.33	.50	1.04	12	9.42	2.44	3.33	1.67	2.80	24
B	14	7	300.0	59.0	1.28	.83	1.06	12	6.78	2.12	3.28	2.5	2.50	24
C	15	5	202.5	79.0	2.42	0.0	1.71	12	5.02	2.16	5.55	0.00	3.88	24
C	16	5	214.9	26.1	3.25	0.0	2.07	12	3.87	1.81	4.08	0.00	2.55	24
C	17	7	241.0	46.5	1.33	0.0	1.17	12	7.14	2.6	3.10	3.5	2.74	24

TABLE VI—*Continued*

CITY	TEACHER	GRADE	COMPOSITION					ARITHMETIC						
			ATTAINMENT	VARIABILITY	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST	ATTAINMENT	VARIABILITY	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST
D	18	5	232.9	30.4	2.50	2.5	2.17	15	6.6	1.9	1.92	2.83	1.68	2
D	19	5	169.0	33.5	2.17	2.17	2.21	15	3.9	1.6	4.5	2.75	4.54	2
D	20	5	196.9	44.1	3.83	0.0	3.51	15	4.0	1.5	2.92	0.0	2.57	2
D	21	5	165.8	36.7	3.83	0.0	3.73	15	4.1	1.5	2.92	0.0	2.73	2
D	22	5	192.8	41.3	2.58	0.0	2.13	15	4.2	1.6	2.92	0.0	2.41	2
D	23	7	326.0	38.5	2.50	0.0	2.4	15	7.9	3.0	2.83	1.67	2.76	2
D	24	7	202.5	85.0	3.83	1.2	4.2	15	6.4	1.8	2.5	1.5	2.83	2
D	25	7	278.3	37.3	3.83	1.2	4.25	15	8.1	2.5	2.5	1.5	2.86	2
D	26	7	241.0	89.5	2.58	2.17	3.08	15	8.4	2.1	2.67	3.17	3.27	2
E	27	5B	328.0	68.0	3.33	0.0	3.22	6	3.76	1.52	3.75	1.50	3.60	6
E	28	5A	217.7	66.2	2.5	1.67	2.35	25	5.84	1.63	4.17	1.33	3.92	25
E	29	5A	284.0	58.0	2.5	0.0	2.16	25	5.15	1.67	3.75	0.0	3.39	25
E	30	7B	322.0	62.0	1.25	.50	1.11	6	7.54	1.77	5.52	1.67	4.97	6
E	31	7A	524.4	40.4	1.3	.50	1.31	25	8.65	1.81	4.08	1.67	4.01	25
E	32	7A	448.0	106.0	2.67	.25	2.45	25	9.29	1.61	2.83	0.0	2.48	25
F	33	5B	132.6	42.6	3.33	0.00	3.80	6	3.15	1.31	2.50	1.67	2.86	9
F	34	5A	164.1	38.9	1.25	0.00	1.32	25	3.83	1.60	3.75	1.67	3.93	28
F	35	7B	240.0	40.0	2.0	0.00	3.8	6	7.83	2.21	4.08	1.67	6.97	9
F	36	7A	255.5	14.5	2.0	0.00	2.93	25	8.59	1.74	4.08	1.67	6.96	28
G	37	$5A_1$	241.0	19.0	2.5	.42	3.87	25	6.71	1.53	3.33	.84	5.14	28
G	38	$5A_2$	153.9	43.9	2.5	.17	1.86	25	7.18	1.97	3.33	1.25	2.47	28
G	39	7B	242.3	20.3	1.3	.17	2.49	6	6.91	2.33	4.08	2.5	4.93	9
G	40	7A	257.5	30.0	1.3	.17	2.49	28	9.43	2.47	3.33	2.5	6.24	28

TABLE VI—*Continued*

CITY	TEACHER	GRADE	RANGE OF VOCABULARY TEST III		READING			HANDWRITING						
								QUANTITY		QUALITY				
			ATTAINMENT	WEEK OF TEST	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	PER CENT QUALITY 9	PER CENT QUALITY 10	ATTAINMENT	VARIABILITY	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST
A	1	5	24.0	12	3.25	3.33	2.20	5	0	10.2	1.43	.83	.42	.58	11
A	2	5	38.0	12	3.33	0.0	2.29	12	14	8.8	.79	1.25	0.0	.84	11
A	3	5	28.0	12	3.73	.83	1.91	45	27	9.3	.66	.92	0.0	.47	11
A	4	5	25.6	21	4.9	2.5	3.36	17	8	9.9	.81	1.17	0.0	.81	11
A	5	5	38.3	21	4.08	0.0	2.91	42	23	9.95	.80	1.17	0.0	.84	11
A	6	5	33.3	21	3.25	1.0	1.99	36	5	10.5	1.33	1.4	0.0	.84	11
A	7	7	57.1	24	1.95	1.67	1.84	3	5	11.17	1.49	.61	0.0	.48	11
A	8	7	61.67	24	2.00	1.50	1.44	16	28	11.64	1.32	.67	0.0	.54	11
A	9	7	64.0	24	2.00	2.00	1.92	4	33	11.28	1.47	.67	0.0	.54	11
A	10	7	66.5	24	1.95	1.5	1.38	11	33	11.10	1.65	.61	0.0	.48	11
B	11	5	44.0	21	1.83	0.0	.92	45	14	11.18	1.14	1.17	0.0	.59	11
B	12	5	33.0	21	5.0	1.25	3.56	9	36	12.25	.53	1.25	0.0	.89	11
B	13	7	60.75	21	2.0	2.0	1.56	20	20	10.75	1.17	.67	0.0	.44	11
B	14	7	60.63	21	1.95	1.0	1.6	2	24	13.7	1.80	.61	.33	.40	11
C	15	5	36.67	12	2.42	0.0	1.71	37	11	10.25	1.21	.92	0.0	.66	11
C	16	5	34.2	12	5.75	0.0	3.70	17	34	10.5	1.29	.92	0.0	.59	11
C	17	7	55.0	12	1.93	0.0	1.69	8	15	10.5	1.19	.61	0.0	.54	11

TABLE VI—*Concluded*

CITY	TEACHER	GRADE	RANGE OF VOCABULARY TEST III		READING			HANDWRITING							
								QUANTITY		QUALITY					
			ATTAINMENT	WEEK OF TEST	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	PER CENT QUALITY 9	PER CENT QUALITY 10	ATTAINMENT	VARIABILITY	HOURS IN SCHOOL PER WEEK	HOURS HOME STUDY PER WEEK	TOTAL COST OF INSTRUCTION PER WEEK	WEEK OF TEST
D	18	5	56.3	20	2.17	2.17	1.89	13	40	10.6	.40	1.25	1.25	1.09	20
D	19	5	42.0	20	2.5	2.42	2.52	18	25	10.6	.22	1.25	1.25	1.27	20
D	20	5	51.7	16	3.17	0.0	3.91	13	33	10.2	.67	1.0	0.0	.88	16
D	21	5	40.0	16	3.16	0.0	2.96	7	4	10.5	.99	1.0	0.0	.94	16
D	22	5	47.0	16	3.83	0.0	3.17	34	14	10.75	.52	1.33	0.0	1.11	16
D	23	7	60.6	16	3.0	0.0	2.96	17	33	10.94	.65	.75	0.0	.74	16
D	24	7	59.1	16	1.67	.42	1.88	18	23	10.67	.47	1.0	0.0	1.13	16
D	25	7	62.2	20	1.67	.42	1.90	9	28	10.93	.59	1.0	0.0	1.14	16
D	26	7	61.9	20	2.42	2.0	2.91	0	21	10.5	.67	1.33	1.42	1.59	20
E	27	5B	39.0	6	3.83	.83	3.67	13	13	10.6	.85	1.67	0.0	1.61	6
E	28	5A	46.0	25	2.08	.83	1.95	25	9	10.5	.83	1.67	.5	1.57	25
E	29	5A	53.0	25	2.0	0.0	1.82	3	0	12.25	1.53	1.67	0.0	1.53	25
E	30	7B	60.5	6	.75	1.0	.68	8	20	10.71	.92	1.67	.75	1.51	6
E	31	7A	62.5	25	2.08	1.0	2.05	14	25	11.30	.99	1.5	.75	1.44	25
E	32	7A	65.0	25	1.75	0.0	1.53	4	0	12.43	.89	1.25	0.0	1.15	25
F	33	5B	27.0	6	4.5	1.67	5.15	67	18	9.74	.36	2.5	0.0	2.86	6
F	34	5A	30.0	25	2.5	1.67	2.63	43	13	9.62	.36	1.25	0.0	1.32	25
F	35	7B	52.0	6	2.0	2.5	3.80	4	8	10.36	.61	.92	0.0	1.46	6
F	36	7A	53.0	25	2.0	3.3	2.93	9	22	10.42	.42	.92	0.0	1.35	25
G	37	$5A_1$	44.4	25	2.5	0.0	3.87	33	33	10.33	.43	1.67	0.0	2.58	25
G	38	$5A_2$	32.5	25	2.5	0.0	1.86	41	46	10.10	.54	1.67	0.0	1.24	25
G	39	7B	52.0	6	2.0	1.0	3.71	25	21	9.9	.61	.67	0.0	1.25	6
G	40	7A	60.9	25	2.0	.33	3.75	27	27	10.3	.77	.67	0.0	1.25	25

CHAPTER V

THE MEASUREMENT OF CLASS SIZE[1]

SECTION 1

THE ATTAINMENT AND OVERLAPPING OF CLASSES IN TABLE VI

If we consider for all systems the attainment of groups smaller than thirty-five and larger than thirty-five in each of the subjects, arithmetic, spelling, English composition, handwriting, and range of vocabulary in terms of the tentative standards[2] suggested, no groups possess superiority by virtue of size. For example, (see TABLE VIII) in the fifth grades the large classes are superior in arithmetic, writing and composition, but inferior in the other traits. In the seventh grades the small classes are superior to the large classes in range of vocabulary, arithmetic and spelling " at grade," equal in writing and spelling measured by "higher grade" and inferior in composition.

A significant measure of the influence of the size of group[3] should be found in the effect which the size of group for four years may exert upon attainment. To test this hypothesis the attainment by small and large groups for these years has been compared with the tentative standards suggested above. By this method we measure the amounts of growth which children taught in classes of various sizes for four years are able to make in terms of a standard.

[1] This chapter includes quantitative studies only. No summaries of present practice are attempted.

[2] See Chapter III.

[3] For additional measurement of class size using data of Table VI see Appendix IV, page 107.

TABLE VII. ATTAINMENT OF SMALL AND LARGE CLASSES

	Composition	Arithmetic	Range of Vocabulary	Writing Quality	Writing		Spelling At Grade	Spelling Higher Grade
					Q-9	Q-10		
System A								
Smallest fifth grade	213.3	2.8	*24.0	10.2	5.0	0.0	24.4	11.25
Largest fifth grade	179.1	4.27	*33.3	10.5	36.0	5.0	46.0	31.60
Smallest seventh grade	308.1	5.24	57.1	11.17	3.0	5.0	51.0	62.40
Largest seventh grade	379.6	7.03	66.5	11.10	11.0	33.0	52.1	68.2
System B								
Smallest fifth grade	176.7	5.53	44.0	11.18	45.0	14.0	51.4	56.1
Largest fifth grade	215.0	4.19	33.0	12.25	9.0	36.0	39.5	31.9
Smallest seventh grade	357.4	9.42	60.75	10.75	20.0	20.0	58.3	64.4
Largest seventh grade	300.0	6.78	60.63	13.7	2.0	24.0	45.6	51.2
System C								
Smallest fifth grade	202.5	5.02	36.67	10.25	37.0	11.0	53.3	33.8
Largest fifth grade	214.9	3.87	34.20	10.50	17.0	34.0	33.7	28.0
Systems A, B, C together								
Smallest fifth grade	176.7	5.53	44.0	11.18	45.0	14.0	51.4	56.1
Largest fifth grade	215.0	4.19	33.0	12.25	9.0	36.0	39.5	31.9
Smallest seventh grade	308.1	5.24	57.1	11.17	3.0	5.0	51.0	62.4
Largest seventh grade	379.6	7.03	66.5	11.10	11.0	33.0	52.1	68.2
System D								
Smallest fifth grade[3]	169.0	3.9	42.0	10.6	18.0	25.0	48.0	35.0
Largest fifth grade	192.8	4.2	47.0	10.75	34.0	14.0	65.0	40.0
Smallest seventh grade	326.0	7.9	60.6	10.94	17.0	33.0	60.0	61.0
Largest seventh grade	241.0	8.4	61.9	10.50	0.0	21.0	60.0	68.0
System E								
Smallest fifth grade	217.7	5.84	46.0	10.5	25.0	9.0	48.6	53.2
Largest fifth grade	284.0	5.15	53.0	12.25	3.0	0.0	61.4	52.2
Smallest seventh grade	448.0	9.29	65.0	12.43	4.0	0.0	81.6	65.2
Largest seventh grade	524.4	8.65	62.5	11.30	14.0	25.0	74.4	66.2
System G								
Smallest fifth grade	241.0	6.71	44.4	10.33	33.0	33.0	56.5	44.9
Largest fifth grade	153.9	7.18	32.5	10.10	41.0	46.0	47.4	47.4
All Systems								
Smallest fifth grade	169.0	3.9	42.0	10.2	13.0	33.0	48.0	35.0
Largest fifth grade[4]	215.0	4.19	33.0	12.25	9.0	36.0	39.5	31.9
Smallest seventh grade	326.0	9.29	65.0	10.94	17.0	33.0	60.0	61.0
Largest seventh grade	379.6	7.03	66.5	11.10	11.0	33.0	52.1	68.2

[3] Smallest regular fifth grade.

In the fifth grades[5] the large classes are superior in English composition and arithmetic, nearly equal in writing and inferior in the other subjects. In the seventh grades the large classes are superior in writing but inferior in the other traits. It is evident from this that in the long run large classes exert some influence upon attainment.[6] The findings of this study yield no correlation with size of group for results taken in a single year. Undoubtedly the effect of size of group in a limited time is negligible. Our measures, however, suggest the possible negative effect upon attainment in a period of years.

TABLE VIII

PER CENT OF CLASSES IN EACH GROUP REACHING STANDARD MEDIANS. BASED ON SIZE OF GROUP IN WHICH THE MEASURES WERE TAKEN

	Composition	Arithmetic	Range of Vocabulary	Writing Quality	Spelling At Grade	Spelling Higher Grade
All Systems						
Small fifth grades.....	25.0	25.0	75.0	87.5	75.0	62.5
Large fifth grades.....	57.14	42.9	35.7	93.0	50.0	57.2
Small seventh grades ..	44.44	77.8	44.4	88.9	22.22	44.45
Large seventh grades ..	55.60	22.2	22.2	88.9	11.11	44.45

TABLE IX

PER CENT OF CLASSES IN EACH GROUP REACHING STANDARD MEDIANS. BASED ON SIZE OF CLASS FOR FOUR YEARS

	Composition	Arithmetic	Range of Vocabulary	Writing Quality	Spelling At Grade	Spelling Higher Grade
All Systems						
Small fifth grades.....	20.0	20.0	100.0	100.0	100.0	80.0
Large fifth grades.....	23.5	48.2	41.2	90.0	47.1	47.1
Small seventh grades ..	57.1	71.4	57.1	85.7	85.7	42.8
Large seventh grades. .	45.45	27.3	18.2	91.0	18.2	33.4

[5] See Table IX.

[6] Of course the attainment is influenced also by the ability of the teacher and no data are at hand to evaluate such influence for four years.

Section 2

The Amount of Overlapping by Grades and Half Grades

overlapping of small and large classes in the separate systems

In this section the comparative attainment of large and small classes is measured by amounts of overlapping. The per cent of overlapping is a significant measure because it gives us at once a measure of comparative status and growth and when computed for the systems separately gives due weight to any special cause which may be operative. With overlapping defined as it has been in Chapter III, the method has been to determine by counting from the arrays of the actual scores made by the pupils in each of the classes, the number of pupils who reach or exceed the median of the 7A[7] grade in the subjects of arithmetic and composition. In spelling the method followed is that described in Table X.

The accompanying table should be read as follows: In Systems A, B, and C, of the pupils in Grade V who reach or exceed the median for pupils in Grade VII, there are in arithmetic, 18.8 per cent, in composition, 4.5 per cent, and in spelling, 19.9 per cent. Of the pupils in the smallest fifth grade who reach or exceed the median of Grade VII, there are in arithmetic, 24.0 per cent, in composition, 3.45 per cent, and in spelling, 22.21 per cent. These computations have been made not alone for each of the grades taken together, but also by classes grouped as to size. Uniformly the attainment by groups of small and large classes, and attainment of the smallest and largest classes of each grade has been studied in relation to the attainment of the seventh grade. Where the number of cases is sufficient, the median attainment of the seventh grade has been used in the systems that have annual promotion; in those that have semi-annual promotion the median attainment of the 7-A grades has been used.

ARITHMETIC

In Systems A, B and C considered together, the per cent of overlapping for the small fifth grades is 15.62 per cent; for the

[7] The letter A throughout refers to the second half year of a grade.

large fifth grades it is 20.6 per cent. The per cent of overlapping for the small seventh grades is 40.6 per cent and for the large seventh grades, 53.3 per cent. The per cents of overlapping for the smallest and largest grades are as follows: Smallest fifth grade, 24.0 per cent; largest fifth grade, 11.1 per cent;

TABLE X

	Arithmetic	Composition	Spelling[8]
Systems A, B, C			
All fifth grades	18.80	4.50	19.90
Small fifth grades	15.62	3.15	20.10
Large fifth grades	20.60	5.51	19.83
Small seventh grades	40.60	34.60	50.10
Large seventh grades	53.30	64.90	49.99
Smallest fifth grade	24.00	3.45	22.21
Largest fifth grade	11.10	11.60	20.75
Smallest seventh grade	19.00	44.70	57.73
Largest seventh grade	62.20	80.50	66.82
System D			
All fifth grades	13.60	17.30	34.60
Small fifth grades (all)	16.67	25.00	39.23
Small fifth grades (regular)	11.10	17.00	31.52
Large fifth grades	8.50	9.70	28.29
Small seventh grades	46.30	68.50	44.20
Large seventh grades	65.50	71.70	55.17
Special fifth grade	30.00	53.80	55.13
Smallest fifth grade (regular)	14.30	8.00	27.43
Largest fifth grade	11.10	11.80	31.88
Smallest seventh grade	54.20	92.30	47.45
Largest seventh grade	73.30	61.30	50.50
System E			
Smallest fifth grade (5-A)	25.00	0.00	27.42
Smallest seventh grade (7-A)	70.80	52.20	45.00
Largest seventh grade (7-A)	68.96	87.10	55.30
Grade 7B	31.00	12.00	55.30
System F			
Grade 5B	2.56	4.87	11.25
Grade 5A	4.76	11.90	7.93
Grade 7B	60.00	82.75	58.45
System G			
5A grades	26.0	55.10	27.45
Grade 7B	26.5	89.70	35.17

[8] The overlapping is measured as the per cent of members of a given fifth grade or group of fifth grades which reaches or exceeds the median of a seventh grade or group of seventh grades in ability to spell sixth grade standard words.

smallest seventh grade, 19.0 per cent; and largest seventh grade, 62.2 per cent. The teachers are rated as equal in all of these grades with the exception of the largest seventh grade in which the teacher is rated as superior to the teacher of the smaller seventh grade. So far as influence of class size is concerned, it is negligible in these results in arithmetic.

In System D, the largest per cent of overlapping is attained in the special class. The overlapping for the regular small classes is 11.1 per cent. The overlapping for the regular large fifth grades is 8.5 per cent. In the seventh grades, the per cent of overlapping for the small classes is 46.3 per cent, and for the large classes, 65.5 per cent. We should expect the special class of the fifth grade to attain the best result; however, considered as individual classes, the group of small classes is not superior. The results attained by the large and small fifth grades making the highest scores are not radically different. Yet it is true that the group of small classes in the fifth grades of this system is superior to the group of large classes, although the amounts by which they differ are not very great. It is significant that in the seventh grades, neither of the small classes reaches as high a per cent of overlapping as the poorer large class. For the smallest and largest classes, the amounts of overlapping are as follows: For the special class of fifteen pupils, 30.0 per cent; for the smallest regular fifth grade, 14.3 per cent; for the largest fifth grade, 11.1 per cent; for the smallest seventh grade, 54.2 per cent; and for the largest seventh grade, 73.3 per cent. Although there are some differences between the performance of certain of the small and large classes, taking all of the classes together, the small classes do not show marked superiority. In System E,[9] the amounts of overlapping are as follows: For the smallest fifth grade, 25.0 per cent; smallest seventh grade, 70.8 per cent, and largest seventh grade, 68.96 per cent. We do not have in this system a fifth grade in the same half year which differs materially in size from the one quoted, so that it is impossible to make a comparison of any value between fifth grades. However, we have the data by which to make a comparison of the seventh grades. As pointed out above, for Systems A to

[9] The reader will observe that the amounts of overlapping in Systems E and G do not differ materially from those found by Courtis between fifth and seventh grades in New York City. Final Report of the Committee on School Inquiry, Vol. I, p. 449.

D, the smaller classes do not appear to possess any superiority. This holds even when we pick large and small classes at random throughout the systems, and is true for the other traits as well.

In System G, the per cent of pupils computed on the total number in the fifth grades that reaches or exceeds the median for the seventh grade is 26.0 per cent. However, the amounts of overlapping for the individual grades vary somewhat more widely than they do in System D, but not nearly so much as they do in Systems A, B and C. The amount of overlapping for the smaller grade is 11.4 per cent. In System F, we do not have a sufficient number of cases for determining the amounts of overlapping of largest and smallest classes. However, the per cent of pupils of Grade V-A that reaches or exceeds the median of Grade VII-A is 4.76 per cent.

Throughout the grades and systems there is variation in the amounts of overlapping, but in no instance is the amount of overlapping correlated with the size of class, nor does the small class seem to possess any superiority. As will be shown in a later section, the amounts of overlapping by the grades and half grades in the various subjects are fairly uniform.

ENGLISH COMPOSITION

The amount of overlapping in Systems A, B and C in English composition is an exceedingly variable quantity. For all fifth grades in terms of all seventh grades, it is 4.5 per cent. Computed as the amount of overlapping for the various groups of grades, we have the following: For the group of small fifth grades, 3.15 per cent; large fifth grades, 5.51 per cent; small seventh grades, 34.60 per cent and large seventh grades, 64.9 per cent. The amounts of overlapping for the smallest and largest classes are as follows: Smallest fifth grade, 3.45 per cent; largest fifth grade, 11.6 per cent; smallest seventh grade, 44.7 per cent, and largest seventh grades, 80.5 per cent. If there were any superiority in the small classes we should expect to find a reversal of these conditions.

In System D, the amounts of overlapping for all fifth grades on all seventh grades is 17.3 per cent. For the exceptional class of fifth grade children, it is 53.8 per cent. The amount of overlapping for the various groups of fifth and seventh grades is as follows: Small fifth grades (regular), 17.0 per cent; large fifth

grades, 9.7 per cent; small seventh grades, 68.5 per cent and large seventh grades, 71.7 per cent. Here, as noted in the other traits, the small classes of this system are superior in the fifth grade. The amounts of overlapping for the smallest and largest classes are as follows: Smallest fifth grade, 8 per cent; largest fifth grade, 11.8 per cent; smallest seventh grade, 92.3 per cent; and largest seventh grade, 61.3 per cent.

In System E, the amounts of overlapping are as follows: No pupils in the fifth grades reach or exceed the median for the 7-A grade. The amounts of overlapping by small and large classes are as follows: Smallest fifth grade, 0.00 per cent; smallest seventh grade, 52.2 per cent; largest seventh grade, 87.1 per cent. In System F, the amounts of overlapping are: For the 5-B grade, 4.87 per cent; 5-A grade, 11.9 per cent; for the 7-B grade, 82.75 per cent. In System G, the amounts of overlapping are: For 5-A grades 55.10 per cent; 7-B, 89.7 per cent.

In no instance cited above, where we have cases so distributed that we may overlap groups of classes of different sizes, do we find any superiority in the group of small classes or in the smallest classes of a grade. The possible exception is in System D, where we do find certain correspondences. However, there are other factors discussed briefly in this section and in detail in Chapter VI, which when taken into consideration explain in part at least these variations.

SPELLING

In Chapter III sufficient evidence has been presented to indicate the fact that for all of the grades in all of the systems taken together, we have growth in spelling ability throughout the grades. In this section, by the same method described in Table X,[10] the amount of overlapping of the fifth grades upon seventh grades and seventh grades upon seventh grades has been computed by large and small classes, for each of the systems.

For detailed relationship see Table X.[11]

[10] See Chap. III, p. 53.

[11] The fifth grades of System F constitute a decidedly inferior group. This statement is based on a careful study by means of the school records of the school population from which these children are drawn, from a study of the progress records of the entire school and from detailed discussion with teachers and supervisors.

Where possible studies were made of the progress of the pupils in the systems in which the tests were given. It was not possible to get the extended

Before discussing further the facts cited in the preceding paragraphs it should be noted that amounts of overlapping for handwriting measured for quantity and quality and amounts of overlapping for range of vocabulary have not been computed. As pointed out earlier in this chapter there is such close correspondence in the scores and variabilities for handwriting for the different classes of the various systems that any amounts of overlapping which might be computed would not be symptomatic measures. Possible reasons for this close correspondence have been suggested. Amounts of overlapping for range of vocabulary could not be computed, because we do not now know the relative difficulty of the words. Our lack of knowledge of valid quantitative standards for handwriting likewise makes it impracticable to infer anything from the amounts of overlapping.

The variations in the data suggest at once that there is no superiority in the small classes of these systems by virtue of the mere fact of size with the teaching ability equalized in the groups.[12] The great variability in overlapping and growth need not disturb us. It is somewhat disappointing not to be able to have amounts of overlapping or growth correspond as precisely as they would were our instruments of measure more refined. We have, however, a sufficient body of data, if used intelligently with that in the preceding chapter, to furnish a basis for standardizing roughly the amounts of overlapping and

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data which would be necessary for a very comprehensive study of this topic. So far as the facts could be studied it was evident that attainment is correlated positively and to a high degree with progress. This is what might be expected if children are classified in an intelligent way. However, it should be mentioned that the potency of such a force may not be neglected in the estimation of the probable effect of other factors. This has been done as far as possible.

[12] The facts cited above with reference to the relationship of attainment and class size are based upon an intensive study of tests given to forty classes in five subjects. Each class was given ten tests, one in spelling, three in range of vocabulary, one in arithmetic, one in composition and four in writing. The same facts are corroborated by the results of the tests given in the classes in Systems H and I which are described in detail in later sections. Altogether the results of the various tests in the nine systems studied summarize the performance of about 12,000 children. For the purpose of studying promotion rate all of the classes in Systems A-F (about 400 classes) were studied.

All of the facts cited in this section and in later sections for classes of the elementary school are abundantly supported by the facts which were obtained from a study of the records of seventy-five high school classes in three subjects. These represented a random selection from one hundred and sixteen classes which enroll about 3,500 high school students.

growth we should expect to find between the fifth and seventh grades.

Section 3

Attainment and Class Size in Other Systems

In this section is presented a study of attainment in oral arithmetic in classes of different sizes, and a study of the amounts of growth in classes of different sizes in the subjects of handwriting, language, and spelling for a period of seventeen weeks as indicated in the table.

These scores represent the work of about ten thousand children in four hundred forty-four classes in two large city systems. City H is a New England city of 40,000, and City I is a city of 25,000 in the Middle States. The measurements were made by a competent man at the time he was superintendent in each of the cities.[13] The tests were given under controlled conditions, uniformly scored by an experienced teacher and, although there may be some differences between the status assigned to a pupil by this method and the status which would be assigned by the use of scales of measure similar to those used in Chapters II and III, in evaluating the achievements of pupils, nevertheless, it is sufficient to say that the relative findings in the classes of different sizes would not be displaced very much. For detailed discussion of the tests and the method of giving them, see the Appendix, Section II.

In City H, eighty-three classes were measured in handwriting on December 4 and again on April 12 of the same school year. The time which elapsed between these dates represents seventeen weeks of school. The papers were scored by an experienced statistical clerk, who used the Thorndike scale. It is significant that the number of small classes which show no growth is nearly three times that of the large classes; it is even more significant because there are slightly fewer small than large classes. The lowest per cents of growth are made in the small classes. A far more reliable measure and far more significant is the per cent of classes of each size that makes a gain

[13] The claim is sometimes advanced that testing directed by a competent superintendent yields results of a far higher degree of validity than those obtained in other ways. While this is probably not a pertinent criticism, the opportunity to present these results for growth in classes of different sizes is utilized.

5,000 Pupils in 131 Classes. 150 Classes Reported. 19 Used for More than One Subject

	Grades 3–5		Grades 6–8		All Grades	
	Under 30	Over 30	Under 30	Over 30	Under 30	Over 30
Handwriting. Growth in 17 weeks.						
1. Total number of classes	22	25	17	19	39	44
2. Number of classes making growth	17	23	14	18	31	41
3. " " " " no growth	5	3	3	1	8	3
4. Highest per cent of growth	27.0	40.0	55.0	44.0	55.0	44.0
5. Lowest " " "	6.0	7.0	7.7	8.0	6.0	7.0
25 Percentile	6.0	10.0	7.7	14.0	....	....
75 "	18.0	25.0	36.0	27.0	....	....
6. Per cent of all classes showing 15 per cent growth or over	41.0	60.0	65.0	74.0	51.0	66.0
Language. Growth in 17 weeks.						
1. Total number of classes	13	20	3	6	16	26
2. Number of classes making gains	7	9	2	4	9	13
3. Largest growth in points	8.5	19.0	11.0	15.5	11.0	19.0
4. Smallest " " "	1.8	.6	2.0	1.0	1.8	.6
5. Range	6.7	18.4	9.0	14.5	9.2	18.4
6. Gain of median class	8.5	5.0	6.5	7.0	....	....
7. Number of classes with losses	5	*11	1	2	6	10
8. Largest loss in points	13.0	7.3	17.0	5.0	17.0	7.3
9. Smallest " " "	7.0	1.5	....	4.4	7.0	1.5
10. Range	6.0	5.8	....	.6	10.0	5.8
11. Loss of median class	10.0	4.0	17.0	4.7	....	....
12. Per cent showing growth of 5 points or over (all classes)	25.0	17.0	67.0	50.0	26.0	20.5
Spelling. Grades 1–3 only.						
1. Total number of classes	11	14	....	....	....	....
2. Number of classes with members making 100 per cent	0	6	....	....	....	....
3. Highest per cent in any class making 100 per cent	0	70	....	....	....	....
4. Lowest " " " " " 100 "	0	3	....	....	....	....
5. Number of classes with members making 50 per cent and over	11	13	....	....	....	....
6. Highest per cent in any class	90	100	....	....	....	....
7. Lowest " " " "	10	6	....	....	....	....

*Three classes make no gain or loss.

The cases above thirty are so distributed that no essential differences appear when they are separated into groups 31–35, 36–40, etc. Because such a grouping puts very few classes into some of the groups, the groups " under 30 " and " over 30 " have been selected.

of 15 per cent or more on the December measure. From the table it is seen at once that the large classes make a decidedly better showing.

In language, forty-two classes were measured. As in the case of writing, the largest gain in points is made in the larger classes; the smallest gains are also made in these classes. It is evident that in this system no size of class possesses superiority. The gain of the median class is a reliable measure, free from ambiguity. It tells us the amount of gain in the middle of the group. If a group shows marked superiority

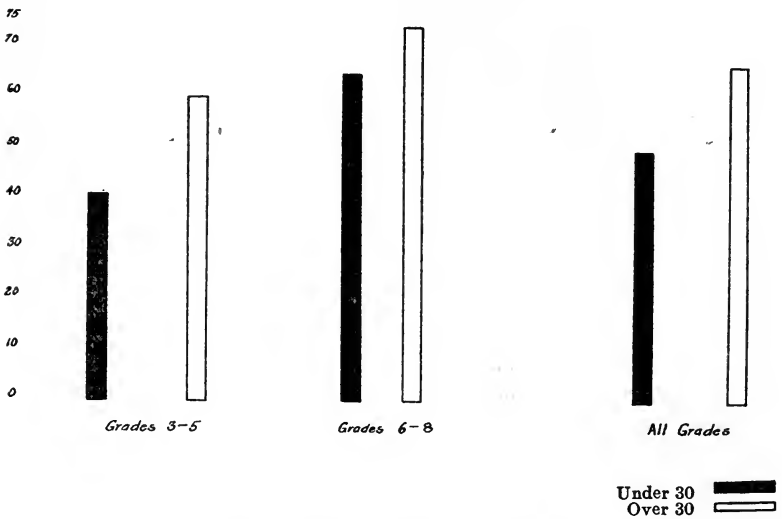

FIG. 6. HANDWRITING. SYSTEM H

Per cents of classes in each grade group that show a growth of 15 per cent or over

obviously its median will have a higher record. There seems to be no superiority in the groups of small classes when the classes are separated by grade-groups. If the results are tabulated to show the per cents of classes of different sizes that show a growth of five points or more, they are consistently in favor of the smaller classes.

The total number of classes tested in spelling was twenty-five. These classes were in grades one to three only. In June, we have for small classes no class making a perfect score. In these same classes for those making over 50 per cent on the test, we

have the following records: 13 per cent, 10 per cent, 28 per cent, 36 per cent, 30 per cent, 59 per cent, 83 per cent, 10 per cent, 77 per cent, 10 per cent, and 73 per cent. In the group of classes of thirty and over, we have the following records for the per cent in each case that makes 100 per cent on the spelling test: 3 per cent, 4 per cent, 70 per cent, 22 per cent, 14 per cent, and 15 per cent. Of this same group, the following percentages make over 50 per cent on the spelling test: 67 per cent, 10 per cent, 6 per cent, 65 per cent, 18 per cent, 72 per cent, 20 per cent, 34 per cent, 48 per cent, and 33 per cent. The per cent of small classes which makes 100 per cent in the spelling test is 0 per cent. The per cent of pupils in the median class of the group whose members achieve 50 per cent or over is 39. In classes over thirty, the per cent of pupils in the median class making 100 per cent in the spelling test is 15 per cent; the range is 3 per cent to 70 per cent for the entire group. Of this group 57 per cent of the classes fail to have any perfect scores. The average per cent of pupils reaching 50 per cent or over and not making perfect scores in classes of over thirty is 35.73. This result tallies closely with all the other results quoted above. In other words, the small classes do not seem to have any marked advantage over the larger classes. Indeed, larger classes are slightly superior to the small classes in a number of instances.

For City I, the classes have been separated into four groups: Fewer than thirty-five, thirty-six to forty-five, forty-six to fifty, and over fifty. In language the largest percentage of classes showing losses are for the classes under thirty-five and over fifty. The largest loss made in any class is in the group thirty-six to forty-five, and the largest gain made in any class is in the group under thirty-five. The highest per cent of classes making gains is in the group forty-six to fifty, in which all of the classes show gains. In order, the other groups are as follows: thirty-six to forty-five, 83 per cent; fewer than thirty-five, 76 per cent; over fifty, 66.7 per cent. The average gain per class is largest in the group forty-six to fifty, next in the group over fifty. The smallest average gain per class is in the group of smallest classes. The per cent of classes which show a loss is as follows: In the group forty-six to fifty, 0 per cent; in the group thirty-six to forty-five, 18 per cent; under thirty-five, 24 per cent;

TABLE XII

LANGUAGE, SPELLING AND ORAL ARITHMETIC IN SYSTEM I.

6,600 PUPILS IN 165 CLASSES. 294 CLASSES REPORTED.
129 CLASSES MEASURED IN MORE THAN ONE SUBJECT

	Fewer than 35	36–45	46–50	Over 50
Language (Written Reproduction).				
Total number of cases, Grades 3–5	29	17	11	3
Number of classes with gains	22	14	11	2
Largest gain in points	36.0	35.4	33.1	16.0
Smallest gain in points	1.0	2.2	3.6	9.8
Gain of median class	8.3	11.8	15.6	9.8
Score of class at 25 percentile	6.00	7.60	4.5	9.8
Score of class at 75 percentile	12.4	16.30	29.0	16.1
Per cent. of classes gaining 10 points	28	50	45	33
Number of classes with losses	7	3	0	1
Largest loss in points	9.4	22.1	0	4.0
Smallest loss in points	.7	1.3	0	4.0
Loss of median class	6.00	15.2	.....	4.00
Spelling.				
Total number of classes in which 100% is scored	43	31	15	5
Highest per cent. in any class making 100%	73.3	65.7	61.7	70.5
Lowest per cent. in any class making 100%	3.0	2.2	2.2	2.9
Number of classes in which 100% is not scored	11	6	3	0
Grades 1 and 2, per cent. of classes with 100%	37.1	37.5	53.4	.....
Grades 3–5, per cent. of classes with 100%	18.0	19.2	18.0	21.0
Grades 6–8, per cent. of classes with 100%	20.0	.....	.....	.....
Total number of classes in which 80% is scored	51	36	19	5
Highest per cent. of pupils in any class making score	80	84.4	60.4	61.7
Lowest per cent. of pupils in any class making score	10	2.8	10.6	20.6
Oral Arithmetic.				
Total number of classes, Grades 3–8	37	66	26	11
Highest per cent. scored in any class	76.2	69.0	63.6	73.07
Lowest per cent. scored in any class	9.0	5.0	12.0	29.1
Number of classes, Grades 3–5	26	27	19	8
Score of median class	45.0	47.3	50.0	36.8
Number of classes, Grades 6–8	11	39	7	3
Score of median class	43.2	35.5	31.3	36.1
Grades 3–5				
Score of class at 25 percentile	33.3	37.8	39.4	30.0
Score of class at 75 percentile	55.5	64.3	60.5	48.5
Grades 6–8				
Score of class at 25 percentile	40.0	26.7	23.7	32.3
Score of class at 75 percentile	55.0	49.0	50.0	50.0
Grades 3–8				
Score of class at 25 percentile	40.0	30.0	30.7	32.3
Score of class at 75 percentile	53.8	50.0	59.4	48.5

over fifty, 33 per cent. There are too few cases of classes showing losses to draw any conclusions from the figures. A very significant measure, however, is the per cent of classes in each group which shows a gain of ten points or over. These per cents are shown in the diagram, and are indicated in the table. These measures, which represent growth measures for a period of seventeen weeks, show conclusively that there is no superiority in the small classes in this city for this subject in the classes measured.

In spelling, the classes under thirty-five possess some superiority to the other groups of classes, if we regard the per cent of pupils making 100 per cent as a valid measure. With this measure, these classes are not very much superior to those over fifty, although the small number of cases in this group (over fifty) makes the measure less reliable. Using as a measure the per cents of classes by groups, none of whose pupils make 100 per cent, the group of classes under thirty-five shows inferiority, for 25 per cent of this group includes no pupils that can make 100 per cent. The results for the other classes are: Thirty-six to forty-five, 20 per cent; forty-six to fifty, 20 per cent; over fifty, 0 per cent. The few cases in the group over fifty make the measure for this group less reliable than the others. Measured by the per cent of classes whose members make 100 per cent, there is very little difference among the groups with the exception of grades one and two, where the highest per cent is in the group forty-six to fifty. For the other measures in the table, there are no essential differences among the groups.

To check these results, the per cent of pupils who reach or exceed 80 per cent in these various groups of classes, was computed. For the group of classes under thirty-five, there are fifty-one classes. Two of these classes or 4 per cent have no members that attain a grade of 80 per cent. The range in grades is from 0 per cent to 80 per cent, or disregarding the zero cases from 10 per cent to 80 per cent. For those classes that do attain 80 per cent or more, the average percentage of children attaining this grade is 38.2 per cent. The median is 40 per cent.

In the group of classes having a membership of thirty-six to forty-five, there are thirty-six. All of this group attain 80 per cent. The average per cent in these classes that attain 80 per

cent to 100 per cent is 37 per cent with a median of 40 per cent. The range in attainment is from 2.8 per cent to 84.4 per cent. In the group of classes forty-six to fifty, there are nineteen. All of these classes attain 80 per cent. Of this group, the average per cent in the classes that attain 80 per cent is 38.7 per cent with a per cent of forty for the median class. The range in percentage is from 10.6 per cent to 60.4 per cent. In the group of classes over fifty in membership all of the classes attain 80 per cent. The average per cent of pupils that attain this record is 45.9 with a per cent of 53.1 for the median class. The range for this group is 20.6 per cent to 61.7 per cent.

In oral arithmetic, the highest score made in any class is made in one of the smallest classes; in this same group of classes, also the lowest score, except one, is made. The next highest score is made in the group of classes over fifty, and its lowest score is over three times as high as the lowest score in the classes under thirty-five, six times that of the classes in the group thirty-six to forty-five, and two and one-half times that

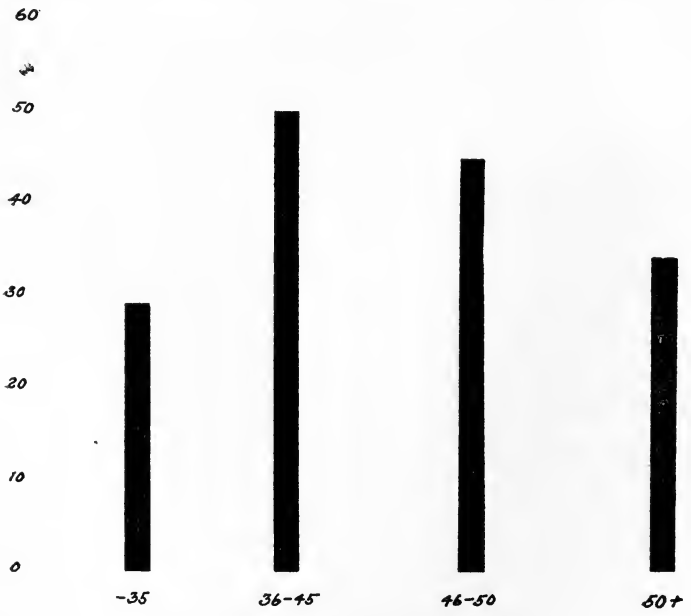

FIG. 7. REPRODUCTION. SYSTEM I.
Per cents of classes of different sizes that gain 10 points or more

of the lowest class in the group forty-six to fifty. As measured by this score when the group is not separated by grades, the best classes are in the groups under thirty-five and over fifty, with no essential difference between these groups or between the groups thirty-six to forty-five and forty-six to fifty. The scores of the median class in each group present no essential differences. The range in ability among the classes in each group is indicated by the percentiles in Table XII.

In the studies of attainment, variability, and measurements of growth, in the classes of Cities H and I, no essential differences are evident among the classes of different sizes. The results are entirely comparable, because the testing was done under the direction of the same superintendent. It is significant that with entirely different cities, with different population groups, with different types of school organization, results taken for the sole purpose of studying the improvement made by children show no correlation between class size and attainment.

Section 4

Class Size Measured by Promotion Rate and Expenditure

That this question might be studied from every important angle, complete data upon salaries and promotion rates were collected in all of the systems. For all of the systems the resemblance between the class size and the rate of promotion has been measured by the Pearson coefficient.[14] This has been selected because it gives a more precise index of relationship than is shown by roughly grouping rates of promotion by class sizes and averaging them. This latter method has been used for a few of the cities, and in addition, the resemblance between class size and promotion rate has been measured for all the classes of sizes sixteen to twenty, twenty-one to twenty-five, twenty-six to thirty, thirty-one to thirty-five, thirty-six to forty, forty-one to forty-five, forty-six to fifty, and over fifty. In no instance is the relationship different from that shown in the table. So far as these cities are concerned there is practically no relationship between class size and promotion rate.

If one were to select a single fiscal measure as symptomatic

[14] The student not familiar with statistical technique will find explanations of the method used in Thorndike's Mental and Social Measurements, Chapters X and XI (1913 edition).

of a school system's condition, he would be justified in using teachers' salaries for the reason that teachers' salaries, roughly speaking, constitute about three-fourths of the budget in American cities. Accordingly the relationship between teachers' salaries in these systems and class size has been calculated by the Pearson coefficient. As in the case of promotion rates, the coefficients indicate a lack of relationship. Although no claim is made that this absence of relationship applies to anything except teachers' salaries and class size, it probably is symptomatic of the relationship of the entire budget to the class size.

TABLE XIII

Class Size Correlated With	Promotion Rate	Teachers'[1] Salaries
Systems A, B, C	—.04	—.29
System D	+.12	—.08
	.....	—.11*
System E	+.116*	+.07
System F	—.07	—.15

* Figures for February, 1914.

[1] Data for System G incomplete. Such computation as could be made indicates the same general lack of relationship.

Section 5

The question of class size has been studied in some detail by a number of investigators. The most important contributions have been made by Rice, Bachman, Cornman and Boyer.

In two extensive investigations Dr. Rice studied among other things the attainment reached by pupils in the elementary school in classes of different sizes. He tested six thousand children in arithmetic. These pupils represented a sampling of the fourth, fifth, sixth, seventh and eighth grades in eighteen buildings of seven cities. In discussing this experiment Dr. Rice says:

"That the amount of resistance offered by non-pedagogical influences is to-day unknown does not by any means indicate that it must forever remain unknown. On the contrary, the problem of modifying conditions is not at all difficult to solve

if we will but look it squarely in the face, divide it into its component parts, and study each factor independently. Analysis of the problem will show that the essential elements of which it is composed do not exceed three in number: (1) The home environment of the pupils; (2) the size of the classes; and (3) the average age of the children." [15]

In his preliminary report of this investigation, Dr. Rice says: " The size of classes must also be ruled out, the results being just as liable to be favorable in large as they are in small classes."[16]

In his final report upon arithmetic and class size he concludes:

" Equally surprising, if indeed not more incredible, may appear the statement that no allowance whatever is to be made for the size of the class in judging the results of my test. I shall not enter into the details in regard to this point, but will dismiss it with the remark that the number of pupils per class was larger in the highest six schools than it was in the schools of City VI, and that the classes were exceptionally small in the school that stands at the lower end." [17]

Dr. Rice also studied [18] the attainment in language in classes of different sizes of eight thousand three hundred children in twenty-two buildings in nine cities. The tests were given to pupils in the fourth, fifth, sixth, seventh and eighth grades. In his report upon class size and attainment he concludes:

" It has always been supposed that the size of the class must necessarily exert a powerful influence on the results. But investigation showed that there was no relationship between the size of the class and the results, and that some of the best work had been done in the largest classes, and some of the poorest in the smallest classes." [19]

Dr. Rice's measurements in classes of different sizes of fourteen thousand three hundred children in sixteen cities were conducted with great care. No one has ever successfully disproved his conclusions, but, on the other hand, they are accepted by every competent student of education as among the best examples of scientific work in education and are regarded as highly trustworthy.

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[15] *The Forum*, Vol. XXXIV, No. 2, p. 286.
[16] *Ibid.*, No. 1, p. 124.
[17] *Ibid.*, No. 2, p. 286.
[18] *Ibid.*, Vol., XXXV, No. 2, p. 269.
[19] *The Forum*, Vol. XXXV, No. 3, p. 445.

In an exceedingly careful investigation made in 1909, Dr. Cornman[20] showed that there is no relation between the promotion rate and class size. He utilized the records for three hundred twenty classes which include all of the classes of District No. 6 of Philadelphia for the term ending in January, 1909. Since the number of cases is sufficient upon which to base conclusions, and since the study was confined to a single district in which the policy in regard to promotion is perforce more uniform than it can be in all of the districts of any large city or in any series of cities under different supervisory management, his results possess a high degree of validity. In the following pages there are quoted the essential tables and arguments presented in this study.

" It has been taken for granted, therefore, that large classes are to be counted among the important causes of retardation and, conversely, that much better results are secured with classes small in size. Such assumptions as these are quite natural. Indeed, it seems almost self-evident that a teacher would do better work with a class of 30 than with one of 40, and that the adverse conditions to be met with in a class of 50 or more pupils must surely be reflected in a marked deterioration in results, if not in complete failure. This view of the relation of the size of the class to the efficiency of the teaching is held so strongly, that the demand for smaller classes is practically universal, and many school superintendents are concentrating their attention upon the problem of reducing the size of their classes from, say, 40 to 50 pupils per teacher to classes ranging from 30 to 40. But the number of pupils per teacher can be reduced only by employing more teachers, so that the question becomes an important one from the economic point of view. For this reason, and also for the pedagogical interest inherent in the problem, the influence of the size of class upon the progress of the pupils is worthy of careful investigation.

"A method by which such investigation may be made is to examine the relation of the size of the class to promotion percentages, the latter constituting a convenient measure of rate of progress. This method was employed with the promotion records for January, 1909, of the schools of District No. 6, Philadelphia. The classes were arranged according to size in

[20] *The Psychological Clinic*, Vol. III, No. 7, pp. 206–212.

three groups: 'under 40,' '40 to 49,' and '50 or over,' and the promotion percentages determined for each group. The results are given in Table I, for each grade separately, for grammar grades (5th to 8th) and for primary grades (1st to 4th) taken together, and for the totals of all the groups. The last line of this table shows that there were 83 of the 'under 40' classes with an average membership of 36 and that 83.2 per cent of the pupils in these classes were promoted; that the '40 to 49' group consisted of 176 classes with an average membership of 45 and a promotion record of 84.5 per cent; and that 61 classes

TABLE I

PROMOTION PERCENTAGES, JANUARY, 1909

Classes Grouped by Size

Grade	Under 40			40 to 49			50 or Over		
	No. of Classes	Av. No. Pupils	Pro-moted	No. of Classes	Av. No. Pupils	Pro-moted	No. of Classes	Av. No. Pupils	Pro-moted
8	9	34	89.2	7½	44	90.0	0	0	0
7	10	36	84.9	8½	45	91.9	4	51	92.1
6	9	30	86.4	19	45	84.1	4	52	89.4
5	11	36	83.4	25	45	87.3	5	54	87.0
4	8	38	81.2	33½	45	84.2	4	52	84.6
3	11	36	87.9	28	45	84.6	12	53	80.8
2	13	36	79.4	32½	44	85.1	9	53	74.2
1	12	36	76.0	22	46	76.4	23	54	76.7
Gram....	39	36	85.8	60	45	87.3	13	53	89.3
Primary..	44	36	80.9	116	45	83.0	48	53	77.9
Total....	83	36	83.2	176	45	84.5	61	53	80.3

with an average membership of 53 had a promotion record of 80.3 per cent. The highest promotion record, therefore, was made by the classes of medium size and the record of the group of '50 or over' was but 2.9 per cent below that of the 'under 40' group. Similar comparisons may be made for each grade separately or for the grammar grades or primary grades taken together. Some of the facts of Table I are given in chart I in order to facilitate such comparisons. Examination of this chart discloses that in the 1st, 4th, 6th and 7th grades and in the grammar grades as a whole the best promotion records were made by the largest (50 or more) classes; that in the 2d, 5th, and

8th grades, in the primary grades as a whole and in all the grades taken together, the medium-sized classes had the best promotion records; and that in only one grade, the 3d, did the smallest classes have the best record. The chart also shows that for the 1st, 4th, 7th, and 8th grades and for the grammar grades taken together the promotion percentages for small, medium, and large size classes increase in the order given, or, as it may otherwise be expressed, the larger the class the better the record.

" In general, it may be said (*a*) that careful scrutiny of the facts of Table I or their graphic representation, Chart I, fails to reveal any advantage in small classes over classes of medium size as regards promotion percentages; (*b*) that the classes of

TABLE II

RATING OF PUPILS, FEBRUARY, 1909

PER CENT " SATISFACTORY " IN SCHOOL WORK

Classes Grouped by Size

Grade	Under 40	40 to 49	50 or Over
8	61	59	66
7	67	60	72
6	55	61	64
5	57	68	61
4	70	69	68
3	72	69	72
2	60	69	75
1	73	76	56
Grammar..	59	61	65
Primary...	71	69	70
Total...	64	69	67

medium size make, on the whole, the best showing; (*c*) that the large classes do not, on the whole, fall much below the other groups; (*d*) that in the grammar grades, the larger the class the better the promotion record.

" To secure additional data upon the relation of size of class to rate of progress, the monthly report cards (for February, 1909) upon which the teacher records her rating of the pupil's conduct or deportment and his progress in school-work were utilized. The percentage of the pupils of a class rated as making satisfactory progress was determined and the classes were then arranged in groups according to size. The results are given in Table II and displayed graphically in Chart II.

" Examination of this chart shows that in the 2d, 6th and 8th grades, and in the grammar grades taken together, the largest classes make the best showing; that in the 1st and 5th grades and in the total for all grades the medium sized classes have the best record; and that in the 4th and 7th grades and in the primary grades taken together the smallest classes have the highest ratings. On the whole, the pupils of the medium size classes have the best ratings and those of the smallest classes the poorest, while again, in the case of the grammar grades, the larger the class the better the rating.

TABLE III

RATING OF PUPILS, FEBRUARY, 1909

PER CENT " SATISFACTORY " IN CONDUCT

Classes Grouped by Size

Grade	Under 40	40 to 49	50 or Over
8	80	85	96
7	76	85	80
6	66	84	83
5	78	80	82
4	89	78	89
3	88	78	90
2	89	80	86
1	90	85	87
Grammar..	77	85	87
Primary...	89	79	90
Total...	84	79	90

" Discussion of these results in a meeting of school principals gave rise to the suggestion that the comparatively poor records of the smaller classes might be compensated for by a ' moral gain ' which could not readily be measured. In order to attempt some measurement of the ' moral gain,' the monthly report ratings for ' conduct ' were also tabulated. The results are given in Table III and in Chart III. The chart shows clearly that the percentage of pupils rated as satisfactory in conduct is greatest in the largest classes, whether we group the classes by primary grades, by grammar grades or consider the entire number of classes without regard to grade; and again in the grammar grades, the larger the class the better the result. The pupils of the classes of medium size are not rated so high in conduct as those of the small and of the large classes.

"A review of Charts I, II and III seems to indicate (*a*) that size of class is not a very important factor in the determination of rate of progress or retardation of the pupils of the class, (*b*) that medium size classes (40 to 49 pupils) make somewhat the best showing, (*c*) that large classes (50 or more pupils) make a poorer showing in primary than in grammar grades, and—as a corollary of (*c*)—(*d*) that it is more important to have small classes in the primary than in the grammar grades. The usual practice, however, is to overcrowd primary classes while grammar classes are relatively small."

More recently the promotion rate for classes of different sizes in the city of Philadelphia has been studied by Boyer.[21] In the succeeding paragraphs there are quoted tables and sample arguments from this study.

" In order to discover the relation existing between the size of classes and school progress, an investigation was made of the promotion records for June, 1913, of the public schools of Philadelphia. In each of the city's ten districts, the classes were divided according to size into six groups as follows: under 30, 30 to 34, 35 to 39, 40 to 44, 45 to 49, 50 and over. The percentage of promotion was then determined for each group. Individual classes showed the widest possible variations in promotion percentages, there being one class in which no promotions were made, and several in which 100 per cent were advanced. In general, however, the variation was limited to a range of twenty points from 75 to 95 per cent with the highest rates occurring most frequently in the upper grammar grades.

" That school progress, as indicated by promotion percentages, does not vary greatly save in exceptional instances, is indicated by table II, where percentages are given for each grade in each group. Nevertheless, that minority of pupils fortunate enough to find themselves in small classes would seem to be the favored few.

" The complexity of the situation, the many diverse factors which enter into promotion, do not warrant us in expecting to find a regular and gradual decrease in promotion rates as classes increase in size. But table II shows some glaring irregularities, *e. g.* the lowest percentages in four grades, (8th, 6th, 4th, 1st), are found in the group next larger than the one showing

[21] *Psychological Clinic*, May 15, 1914, Vol. III, No. 3, pp. 82–90.

the highest percentage. Again, in the fifth grade an exceptionally low percentage is shown in the smallest size group. This represents only one class, however, and is an illustration of the operation of other forces than class size. It is probable that in this small class were concentrated the 'slow' fifth grade pupils of the school concerned in order that special attention might be afforded. That such irregularities are exceptional is indicated by the fact that on massing together the grammar classes, the highest percentage, 88.2, falls in Group II, even though Groups I, II, and III, have shown three lowest percentages. The same is true of primary classes which show two lowest

TABLE II

PROMOTION PERCENTAGES IN EACH GRADE-GROUP—DISTRICT NO. 7

Groups	Grades								Total Grammar	Total Primary	Total
	8	7	6	5	4	3	2	1			
I. (–30)	88.3	....	96.4	62.5	87.0	....	....	90.8	85.3	89.4	87.4
II. (30– 4)	90.3	....	76.4	87.9	70.7	94.1	81.8	70.9	88.2	73.7	79.5
III. (35– 9)	84.5	86.5	78.2	82.5	84.4	85.0	82.9	73.9	83.1	81.1	81.9
IV. (40– 4)	89.8	85.7	81.7	83.2	81.2	82.5	82.5	81.9	83.9	82.0	82.8
V. (45– 9)	89.0	83.4	81.9	80.4	82.8	81.4	77.8	74.9	81.9	79.1	79.9
VI. (50+)	....	66.7	81.7	80.5	79.7	77.3	82.0	73.7	80.1	78.8	79.1

percentages in Group II, while the highest percentage for total primary is found in Group I (89.4). In the total of all grades the highest percentage, 87.4, is found in the smallest group, and the other percentages vary less, as might be expected.

" The irregularities of table II, together with the fact that a somewhat similar investigation pursued by Dr. O. P. Cornman, in District No. 6, in January, 1909, showed very different results, led to the extension of this study to include the other nine districts of the city. Classes were distributed into six size groups, promotion percentages computed, and tables similar to table II constructed. In none of these nine districts were the highest percentages concentrated so overwhelmingly in the smallest size groups.

" In District No. 6, where the highest rates are evenly divided, the four highest percentages found in the larger classes (Groups

IV, V, and VI) are all in grammar grades. There are no grammar classes in Group I. The highest percentages are only very slightly in advance of the percentages shown in the smallest groups except in the sixth grade, where a specially low percentage is shown in Group II. In the four primary grades the highest rates are found in the three smallest groups. (Table IV.)

" District No. 9 is the only one having the greater number of highest percentages in groups of classes over forty. Examination of table V will show that of the five highest percentages in larger groups, four are found in Group IV (40-4) and only one in the very largest group (50 and over).

TABLE IV

PER CENT PROMOTED BY GRADE-GROUPS—DISTRICT No. 6

Groups	Grades							
	8	7	6	5	4	3	2	1
I. –30.....	....	....	....	....	83.6	89.0	62.0	89.2
II. 30– 4.....	91.8	90.9	64.5	....	75.4	73.8	90.8	87.1
III. 35– 9.....	84.0	88.4	86.2	86.0	88.7	80.0	83.8	67.0
IV. 40– 4.....	88.3	91.6	79.9	85.3	85.1	76.8	85.5	65.3
V. 45– 9.....	89.7	82.6	86.3	83.8	87.2	85.9	85.7	77.1
VI. 50+	93.3	79.8	85.5	86.2	84.4	75.0	80.7	68.7

TABLE V

PER CENT PROMOTED BY GRADE-GROUPS—DISTRICT No. 9

Groups	Grades							
	8	7	6	5	4	3	2	1
I. –30.....	87.0	93.1	....	....	75.9	89.3	....	80.0
II. 30 –4.....	86.2	91.5	100.0	81.4	81.3	82.4	76.9	72.7
III. 35 –9.....	78.4	82.2	86.1	81.6	85.2	86.7	83.8	71.4
IV. 40 –4.....	92.4	83.5	82.3	85.5	84.8	81.9	87.0	83.1
V. 45 –9.....	84.4	87.1	81.2	83.3	77.2	81.8	84.5	76.9
VI. 50+	....	90.1	87.0	77.9	87.4	78.2	81.6	77.4

" Further examination of table VII will show that only in the seventh and fifth grades is there a gradual shrinkage of percentages as the classes grow larger in size, but this is not surprising in view of the unequal distribution of classes among the various size groups. Moreover, the lowest rates in the sixth, fourth, and second grades are located in groups smaller than those indicating highest percentages. But these apparently unwarranted stragglers are more than counterbalanced by the fact that in the remaining five grades, (eighth, seventh, fifth, third, and first) the lowest rates are shown in the largest size-group, *i.e.* fifty and over.

" On combining totals for the four grammar grades, a regular descent in promotion rate is shown, *i.e.* from 89.8 per cent in Group I to 82.5 per cent in Group VI (see column 9, table VII). Could we stop here, a fairly clear case for smaller classes might be established; but total primary rates seem to indicate that medium sized classes have the advantage. Groups III and IV show an average of 85 per cent while both smaller and larger groups hover around the same rate, 80 per cent. In the percentages of the grand total of elementary pupils, these advantages neutralize each other and approximately the same progress is indicated for all classes having less than forty-five belonging. In each of these four groups the rate is very close to 85 per cent and the falling off in rates shown by larger classes is correspondingly more noticeable. These lower rates (82.7 per cent in Group V and 80.1 per cent in Group VI) are seen to be of no mean significance when it is recalled (table VI) that they are the promotion percentages of 48.9 per cent of the total number of classes in the city, and that these classes contain 55 per cent of the total number of elementary pupils."

The results of Boyer agree only in part with those of Cornman, but do not, on the other hand, disprove the fact that no relationship was present in 1909 when Cornman made his study. Boyer does not give us a complete distribution of percentages of promotion by class sizes. If one carefully examines his tables he will note that frequently the largest classes have per cents of promotion that differ but little from the per cents in the smaller classes; however, it is true that in some instances the highest single per cents do fall in the group of smallest classes. Boyer further attempts to compute the expectancy of

repetition in the grades without considering individual histories. Again the use of records from several districts introduces an amount of error which he does not attempt to correct and he does not use so precise a measure of relationship as a coefficient of relationship. He frankly admits the many irregularities which are evident in his study. So far as his data are concerned there is apparently no significant relationship between class size and promotion rate.

Bachman[22] in his study of class size and promotion rate in the schools of New York City points out that although there are slight differences in the promotion rate in some groups of small and large classes these differences are not sufficient in amount to warrant changes in the policy of assignment[23] of class size. The facts and arguments are summarized in the following quotation from the report:[24]

" When the several grades are considered as a whole it will be observed that the highest per cent of promotion was in classes under thirty-five, the rate being 89.36 per cent. The rate of promotion in classes of thirty-five to forty was, however, only .22 of 1 per cent less, and, in classes of forty-one to fifty, only .41 of 1 per cent less than in classes under thirty-five. Hence, for practical purposes, the rate of promotion was the same in all classes having fifty and under. But the rate of promotion in classes of fifty-one to fifty-five was lower than in classes under thirty-five by 1.68 per cent, in classes of fifty-six to sixty by 5.91 per cent, and in classes over sixty by 18.17 per cent. The major part of the difference in the rate of promotion, at least in classes of fifty-six to sixty, and in classes over sixty, in comparison with the rate of promotion in classes under thirty-five was, however, due to the fact that pupils in the classes of these two sizes are principally in the lower grades, where the rate of promotion is relatively low. No such differences, it will be observed, appear, if comparison is made, grade by grade, between the rate of promotion in the classes of the several sizes.

" The differences, such as they are, in the rate of promotion

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[22] Final Report of the Committee on School Inquiry, 1911–1913, Vol. I, pp. 606–609.

[23] The reader is warned that this discussion refers to *promotion rate only.* No measurement of the ability of the children in these grades was attempted by the Committee on School Inquiry.

[24] Report of Committee on School Inquiry, *op. cit.*

within each grade, in these different-sized classes, become clearer, if all classes of fifty and under are combined and all classes of over fifty, and comparison is made between the rate of promotion in classes of these two sizes only. Table XVII gives by grades the per cent of promotion in classes of fifty and under, in classes of over fifty, and the per cent of promotion in classes of fifty and under, above or below the per cent of promotion in classes over fifty; also the increase in number of pupils that would have been promoted in classes of over fifty at the rate of promotion in classes of fifty and under.

" In nine out of sixteen grades the higher rate of promotion at the end of the February-June term, 1911, was in classes of fifty and under; in seven the higher rate was in classes of over fifty. The rate of promotion was higher in classes of over fifty in the 1-B, by .29 of 1 per cent.; in the 4-B by .59 of 1 per cent; in the 5-A by 1.29 per cent; in the 5-B by .09 of 1 per cent; in the 6-B by 1.58 per cent; in the 7-B by 3.09 per cent; and in the 8-B by 2.18 per cent. But the difference in the rate of promotion was either so small or the pupils in the given grade were so few that the higher rate of promotion in classes above fifty in these seven grades makes a difference of only 134 promotions.

" In each of the grades 1-A—4-A,—containing 80 per cent of all pupils in over-size classes—the rate of promotion, with the exception of the 1-B grades, was higher in classes of fifty and under. But, with the exception of the 1-A grade, the differences in the rate of promotion are too small to affect materially the number of promotions. The higher rate for classes of fifty and under in the 2-A grade would have increased the number of promotions in classes of over fifty by nineteen—the equivalent of one additional 2-A promotion to each 386 pupils; in the 2-B by seventy-nine—the equivalent of one additional 2-B promotion to each 104 pupils; in the 3-A grade by fifty-two—the equivalent of one additional 3-A promotion to each 139 pupils; in the 3-B by forty—the equivalent of one additional 3-B promotion to each 167 pupils; and in the 4-A grade by seventy-eight—the equivalent of one additional 4-A promotion to each sixty-seven pupils. In the 1-A grade, however, the higher rate of promotion would have increased the number advanced by 592—the equivalent of one additional promotion to each twenty-

five 1-A pupils in classes of over fifty. The rate of promotion in classes of fifty and under was also higher in the 7-A by 6.78 per cent, and in the 8-A by 7.77 per cent. The number of pupils in these grades was, however, small, so that, had the higher rate for classes of fifty and under prevailed in classes of over fifty, the number of 7-A promotions would have been increased only twenty-nine, and the number of 8-A promotions only twenty.

" Thus, although the higher rate of promotion is found, in the majority of grades, in classes of fifty and under, this higher rate is so small that, had promotions in each of the several grades been the same for classes of over fifty as for classes of fifty and under, there would have been, in classes of over fifty, a net increase of only 789 promotions out of a total of 73,991 pupils—the equivalent of one additional promotion to each ninety-four pupils in classes of over fifty."

The most evident conclusion is that promotion rate is probably not a measure considered by itself. It must necessarily be an inadequate measure because of the probability that it will be influenced by administrative policy[25] and community sentiment. If studies of promotion rates are utilized along with other measures of progress and measures of attainment they become valuable as aids for the interpretation of data.

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[25] For an excellent discussion of phases of this problem, see Fifteenth Annual Report of the City Superintendent of Schools of New York City, pp. 41–44, July 13, 1913.

CHAPTER VI

SUMMARY AND SUGGESTED INTERPRETATIONS OF THE DATA

What These Tests Measure[1]

Aside from studies of the records of the pupils in these tests, their variation and the amount of growth by grades, as presented in the preceding sections, one large problem of this study has been to determine, if possible, the relationship which exists between attainment and size of class. So far as the records of these tests are valid, there is apparently no relationship between the size of class in which the children have been taught during the present year and the attainment or variability. Although this result is presented for what it is worth on the evidence collected, nevertheless, it is in order to suggest reasons for this absence of correlation.

In the first place, possibly these tests do not measure the ability of school children in the various subjects tested. Even if they did measure the ability and to a sufficiently fine scale that the units were comparable with the units of class size, nevertheless, the variations among the attainments of the different classes are far greater than the variations in the class sizes which would suggest at once little possibility of relationship between class size and attainment.[2] For example, the average of all the class sizes is 35.5, with an A.D. of 5.75, whereas the average of all spelling records is 52.5 per cent, with an A.D. of 12.4. The same general relationship holds for arithmetic, English composi-

[1] Extended discussion of the relation of time cost, expenditure and amount of home study is not made. The facts have been presented in the tables merely that anyone who is interested in making comparisons between typical attainments, typical time allotments, etc., may have here a tentative standard. It will be observed that there are no consistent relations between these factors and attainment. In many instances it actually costs less in money and time to attain a higher result in the larger classes.

[2] Various so-called tests of mental ability, have the same fault; they do not seem to correlate, i.e., the status of a pupil in a certain test is likely to be very much changed in other tests.

tion, and range of vocabulary, but does not hold for handwriting measured for quality.

Again there may be something inherent in the groups which are tested, which cannot be estimated. It may be that there is present some constant error, and that it is impossible to estimate what this is, aside from the constant errors which would be present in the ratings of one experienced person. Such a constant error should be small for all of the data, as a person experienced in making ratings did the rating for all of the classes. The most evident conclusion is that we must study these tests far more closely and subject our methods of investigation to far sharper scrutiny than we have done heretofore, before we claim too much for them as measures of ability in these various subjects.

The tests are designed to measure school work. If upon anything, they are based on actual school work, and the measurements are made upon the basis of scales derived from school work. The Hillegas and Thorndike scales were made from samples of children's work; Buckingham's lists of words were derived from school lists and those of Rice; the problems of Courtis and the list of words for the range of vocabulary test have a like origin. But even with these considerations, we have no means of estimating without further experimentation with the same children in how far these tests measure complexes of school ability and native capacity of the children in these subjects, and it is conceivable that these tests may measure largely the ability of the teacher to produce results in the pupils under her charge.[3] There is evidence throughout the study that the ability of the teacher exerts a potent influence upon the attainment of the group. In every instance in which there is a close approach in attainment of the half years of a grade, the teachers of the lower half are equal or superior to those in the second half year. In general, the class taught by the teacher with the superior rating shows a higher per cent of overlapping in all the subjects, irrespective of the size of the class. Other evidence of the influence of the ability of the teacher is found in the fact that if we compare the attainment of children

[3] The amount of strain which the teacher bears in the larger classes is a matter that cannot be estimated on the best evidence obtainable but seems to be a variable quantity; many teachers prefer large classes and complain little about undue strain. In other instances teachers insist that small classes are necessary to relieve over-strain.

taught by one teacher with attainment of the children taught by the other teachers of a system, we note great differences in the amounts of variability. This holds for all subjects except handwriting and is one form of evidence that must be taken into account. However, this should be corroborated by the demonstration of a relatively high coefficient of correlation between the attainment of the class and the ability of the teacher. Such an extensive problem was not one of the problems of this study and our limits would not permit the gathering of the large number of ratings for each of the teachers without which it is impossible to estimate the amount of this influence. On the basis of the ratings gathered, great care has been taken to equalize the influence of teaching ability in all instances in which conclusions concerning attainment and size of class are advanced. Further than this we can at this time only suggest the great importance which an extensive study of teaching ability holds for educational administration.

THE USE OF VARIABILITY AS A MEASURE

The absence of relationship between the variability and size of class would not be highly significant were it not for the absence of relationship between attainment and size of class[4] which the records of the various tests indicate. It should be emphasized that variability as a measure of efficiency or of anything else is to be used with very great caution because without most explicit definition it is extremely difficult to know exactly what variability measures. The results in this research are sufficient to indicate that the presence and great range of variability are facts that can be explained only by evidence from many sources. The use of variability as a measure by itself cannot be regarded as trustworthy.

Complete summaries of all the data in charts and tables have been presented in Chapter III with the suggestion that these be used as tentative standards by students who desire to repeat the measurements utilized in this study. In addition these tables furnish standards for the derivation of better and more

[4] The Pearson coefficient between class size and attainment has not been computed for any of the cities. It would not be a very significant measure because if the grades are all taken together we should have a mixture of species; when the grades are separated the number of cases is not sufficient to give a reliable measure.

complete distributions as work of this character is extended. Again it is hoped that the method may prove suggestive in developing more extensive methods for making surveys of the class room work of the elementary school.

A further analysis of the results indicates in general a lack of correlation between the size of class in which the children have been taught and such factors as are commonly accepted as adequate measures of school work and progress. It is significant, moreover, that the results obtained in this portion of the study are in general agreement with every investigation of the question of class size that has been carried out in a scientific manner.

Yet these results are the opposite of what we might expect were we to take as our guide mere opinion. A careful study of some one hundred and fifty school reports, and nearly all of the surveys that have been made in the past few years, reveals the fact that the opinions of supervisors and officers tend to be in favor of classes of forty or under. Typical opinions and rules of Boards of Education based upon opinion are suggested in the following paragraphs:

"**Distribution of Pupils.** In view of the large number of pupils to be cared for and the varied conditions that obtain in the distribution of the population, the apportionment of pupils among teachers was as equitable as circumstance would permit. For example, in the fifth month there were twenty-one teachers who had over forty-five pupils, ninety who had from forty to forty-five, one hundred and thirteen who had thirty-five to thirty-nine, and one hundred and fourteen who had thirty to thirty-four.

" The average number of pupils based on total enrollment per teacher in the elementary schools was forty, but on the basis of the average number belonging it would be reduced to thirty-four. In several buildings the average number per teacher is necessarily small and this has the effect of lessening appreciably the average for the city. For example, in the Jordan, Bonneville and Lake Breeze schools, which are somewhat isolated, effective work can be done only when the average number of pupils to the teacher is about twenty. Even under these conditions the teacher must have two or three different grades in her room. The Jordan has forty pupils in six grades, with two teachers; the Lake Breeze, twenty pupils in four grades, with one teacher; and the Bonneville, ninety pupils in seven grades, with four teachers. Then the nature of the work in the Bryant

requires a reduced number of pupils for each teacher, the average for the thirteen teachers there being but little over that in the high school. Again, in the Twelfth school, where we deal with atypical children, it is necessary to keep the average under twenty.

" In the kindergarten each teacher had during the year an average of fifty-three different children under her charge, but the average enrollment for any month did not exceed thirty-five for each teacher.[5]

"Classes in the Elementary Schools of Commendable Size. The school authorities deserve much credit for keeping up with the very rapid increase in school population, which has been taking place during the last decade, with an equally rapid extension of the school plant and increase in the number of classes, with the result that all pupils are afforded a full day's schooling, and that in classes of very favorable size, in comparison with those of most large, rapidly growing cities. While many such cities are struggling to give thousands of pupils a full school day, and to reduce the size of elementary classes to forty-four, forty-two, or forty pupils, as a practical ideal for the immediate future, Portland schools are already enjoying the great advantage of an average membership of scarcely thirty-six. While an average membership of thirty is preferable to one of thirty-six, the authorities will do well, in the next few years, not to let classes increase over the present size." [6]

"Sec. 50. First grade classes shall consist at the beginning of the school year of at least forty pupils enrolled. Whenever the average daily attendance shall fall below thirty-five, the Superintendent shall report the fact to the Board, and if in his judgment it be advisable, shall recommend a plan for consolidation or for the formation of a new class. Other primary and grammar classes shall consist of at least forty-five pupils enrolled at the beginning of the school year, and the Superintendent shall likewise report when the average daily attendance falls below forty. In schools having less than four classes, these numbers may be modified to meet the needs of classification. In classes of the same grade, in any particular school, the number of pupils should be kept as nearly equal as possible.

"Sec. 51. Teachers of mixed first and second grades, shall receive first grade pay, providing that their classes have an average daily attendance of thirty pupils in the first grade." [7]

[5] Twenty-third Annual Report of Salt Lake City. For the school year 1912–1913.

[6] Report of the Survey of the Public School System, City of Portland, Oregon Dec. 27, 1912, p. 124.

[7] Rules and Regulations of the Board of Education, San Francisco. Adopted, Dec. 28, 1910.

"**Sec. 11.** The number of teachers to be assigned to any school building shall be determined upon the basis of an average daily enrollment per month of not less than forty, or more than fifty pupils per teacher for graded schools, and not more than thirty nor less than twenty-five pupils per teacher for high schools. Exceptions may be made in case of schools in remote districts." [8]

"**Regulation 44. Required Daily Attendance.** Forty pupils, average daily attendance, shall constitute a class. Any wide variation from this number is to be explained to the Committee on Teachers and Salaries by the Superintendent of Schools."[9]

" Whenever the register number of children in a class in an elementary school, excepting open-air classes, ungraded classes, and classes for blind, deaf, truant, or crippled children, falls below thirty or rises above fifty, the principal or teacher in charge shall notify the District Superintendent, who shall report to the City Superintendent of Schools the steps that should be taken, by consolidation of classes, transfer of pupils, or other means to secure an economical distribution of teachers and pupils (As amended May 14, 1913)."[10]

" No grammar grade shall have less than forty pupils, except in the eighth grade, where the minimum shall be thirty, except by permission of the committee on instruction and educational supplies." [11]

As contrasted with these opinions we have other opinions from supervisory officers of equal competence:

" It may be that better results are not obtained with small classes because the teachers have become so accustomed to dealing with the larger classes that they are not able to adjust themselves and adapt their methods to it, when they meet the small class. Some evidence in favor of this view is found in the preference held by many teachers for classes in the forties. ' I feel as if I do not have enough to work upon in a class of thirty,' is the way this preference is often given expression."[12]

The superintendent of schools for Newark, New Jersey, suggests that " The manual and craft studies will not admit

[8] Rules and Regulations and Course of Study, Minneapolis Public Schools, 1910-1911, p. 12, Sec. II.

[9] Rules of the Board of Education of the School District of the City of Cincinnati, adopted, April 17, 1905, p. 83.

[10] Manual of the Board of Education, City of New York, 1914.

[11] Newark, N. J., Board of Education, Fifty-fourth Annual Report for the school year ending June 30, 1910, p. 293.

Compare with these quotations the elaborate schedules for the assignment of class sizes in Report of the School Committee, Boston, Mass., 1910, p. 72, Sec. 292.

[12] *The Psychological Clinic*, Vol. III, No. 7, p. 211.

so large a class as from thirty-five to forty." In the same section of the report, he recommended that "Although no specific rule can be laid down as to the size of the class, there is a general rule that a class of say thirty-five to forty pupils on the average can be handled efficiently by most teachers." In other sections of the same report, he recommended that " The cost of high school maintenance be reduced by reducing the number of teachers and increasing the size of the classes." [13]

It is needless to multiply opinions. Accumulating a vast array of opinions leads us no nearer the solution of a problem. But when we have a body of data taken with the great care that has been used in gathering the results in the present study, we at least have a basis for analysis in the light of our best knowledge, and may suggest helpful interpretations that take into account all of the factors so far as we are able to estimate them.

It is unnecessary to review the evolution of the various types of schools and types of teaching. These facts may be gleaned from any of the authoritative treatises on the history of education.[14] Prior to the eighteenth century, school instruction ranged from tutorial instruction to instruction in classes of large size in schools of elementary and secondary grade. In the schools of the Port Royalists in the seventeenth century a definite attempt to organize schools with very small classes appears. In the latter part of the eighteenth century, and in the early part of the nineteenth, there was ushered in a period of provision for education, upon a more extensive scale than had hitherto been attempted. The Sunday School movement, the Infant Schools, and the Monitorial Schools introduced in a peculiar way new problems of class teaching. The problem was largely one of administration, and required the handling of groups of children by a teacher or master and assistants. This problem developed until the ideal in the Lancasterian system was to have a teacher with a large number of monitors, in charge of the instruction of one thousand pupils.

The wide introduction of the monitorial system in the United States tended to establish a policy of large classes, particularly

[13] Annual Report of the Superintendent of Schools, Newark, N. J., 1912.

[14] Readers are referred to such standard works on the History of Education as those by Monroe and Graves, and also the Encyclopedia of Education, edited by Paul Monroe, and similar treatises.

in the lower grades. Thus with the passing of the system there was left no considerable discontent with large classes. The persistence of the ideal of organization is still found in such cities as New York, where to-day a number of buildings are in use, whose construction and interior arrangement follows the pattern suggested by the monitorial schools of an earlier day. The popularization of education, the enactment of compulsory attendance laws, and the increase in the density of population, have increased the school attendance in the majority of communities at such a rate that provisions for schools have not kept pace, and this has tended to reinforce the existing tradition in favor of large classes. Again the enrichment of the curriculum, the increase in expensive buildings and equipment, the addition of special schools, have all tended to make the reduction of the size of classes a difficult matter, and to accentuate its importance as a problem in American school administration. In the upper grades, a counter force appears in the form of elimination which tends to reduce the number of pupils per teacher. The fact is abundantly illustrated in the tabulations by classes and grades in any city report. Unfortunately it is a condition found in nearly all of the growing cities of the United States.

The relatively large groups of children that are marshalled for instruction have caused, for many years, the presence of large classes in our elementary schools, and the necessity of devising means by which to cope successfully with the problems of mass teaching has tended to evolve a type or pattern of teaching which has become established in American teaching and supervision. Even in the smaller classes in the higher grades, where the more rigid ideals of grading and elimination have reduced the number of pupils per teacher, the conventionalized methods of teaching have been the same. Probably the fact that teachers in the upper grades are drawn largely from the experienced teachers of the lower grades has contributed to this condition. Teachers do not distinctively change their methods of instruction when they have smaller classes. The testimony of progressive supervisors bears witness to the fact that it is very difficult to get teachers to do much individual teaching even when they have small classes. This is corroborated, moreover, by the fact that many teachers

actually prefer classes of about forty for here they do not feel the pressure to combine individual teaching with group teaching. In his study of promotion rates and class size Cornman suggests:

"Again it may be that the pupil does not reap the advantages supposed to accrue to him in small classes unless the class becomes *so* small that the teacher may direct a large share of attention to the study of the individual peculiarities of her pupils and to the employment of special methods in each child's behalf. The possibility of realizing these conditions is found only in the 'special class' of from fifteen to twenty-five pupils. As was said editorially in a former number of *The Psychological Clinic*, ' The grade teacher is interested in teaching reading, writing and arithmetic. The special teacher must be interested in developing the individual child. . . . In the grades attention must ever be centered upon the curriculum, pedagogical methods and the result as shown through class promotions. There is a problem of mass instruction, and there is an entirely different problem of individual development. These should be kept separate and distinct, and the public schools should never give up the older ideals of mass instruction. Clinical psychology and the special teacher will not supplant the more general features of the public schools; they will only supplement what is already to be found in the schools, in order to make the work effective in meeting special conditions.' The cost of reducing regular classes to an average size of even thirty pupils would be so great as to be practically prohibitive, so that the public schools could not give up the older ideals of mass instruction. Perhaps the most economical, as well as most effective, solution of the problem is the maintenance of regular classes of medium size—between forty and fifty pupils—the gradation of which classes shall have been greatly improved by transferring from them to special classes—fifteen to twenty-five in membership—for individual pedagogical treatment of all pupils who seriously deviate in their physical, mental, or moral characteristics from the average or normal child." [15]

Under recent demand for small classes so that there may be more individual teaching, the conventional mass teaching tends to be the type. The analysis of the conditions as cited

[15] *Psychological Clinic*, Vol. III, No. 7, pp. 211-212.

above for the city of Philadelphia by so competent an investigator as Dr. Cornman bears witness to this fact. The fact that classes of twenty-five or thirty do no better than those of forty or fifty does not indicate that all classes should be made larger in the interest of public economy. One class among those studied in this report is a special class in which there is a large amount of individual teaching, and in this the results are such as to indicate the possibility of getting higher attainment with a selected group of pupils in charge of an exceptional teacher, who introduces a large amount of individual teaching. Such conditions are duplicated throughout the United States in many experimental and special situations. The problems of mass instruction for the great majority of children, however, belong in an entirely different category. The results presented in this study indicate that instead of making all classes larger in the interest of public economy, on the contrary, two policies must be pursued:

1. That new standards of individual adjustment to teaching and supervision shall supplant in part present class or mass methods of teaching as an ideal.

2. That the size of classes in the elementary school shall be reduced to numbers smaller than what may become a desirable norm, in order that teachers may be freed from the conditions which have produced a traditionalized mass teaching, and thus be given an opportunity to develop the new type of teaching in classes which shall take account of individual differences.

On the other hand, it must not be assumed that classes can be indefinitely reduced with increasing efficiency in instruction. If such were the case, the instruction of a single child by a tutor would give a most competent education. It would be better than school education. Such an assumption leaves out of account all the incidental instruction that a pupil gets from his fellows, all the concrete social experience of adjusting himself to the group life—a thing that makes him another individual,—in short, all the stimulus that comes from contact with others.

In recent years researches in social psychology have established several truths which find their application in the group life of the school, and in the performance of children in groups of various sizes. In the first place, the results of Schmidt,

Mayer, Meuman, Triplett, and Feré indicate that people working in groups do far better than persons working alone. The results of Meuman show particularly that as the group increases in size, the accuracy and amount of work increase. Mayer and Meuman, by measuring the effects of distractions, have both shown that attention is stronger in the group than in the individual.[16]

This dynamogenic[17] effect of various social factors, one of the most important of which is the size of the group, upon the performance of individuals, is a matter much neglected in school work. The results in the present study indicate the influence of this factor, and emphasize the fact that the rôle it should play, and the amount of influence it should have, are among the important problems in the assignment of class size. This implies that the desired condition in instruction is one where the group is small enough to enable the teacher to give adequate personal attention to the pupil and yet large enough to provide all the important influences which come from working in groups. How large then should this group be ?

The fact that school attendance tends to be better in the larger groups in the cities examined and in certain of the schools of New York City indicates that children like to be with a crowd,[18] as well as affirms the fact of the dynamogenic influence, but does not argue that we should determine the size of classes by this single measure.[19] Capacity for individual learning is doubtless a far better characteristic for a class to possess than almost perfect attendance. Besides one may get attendance in other ways, as by more interesting and vital teaching which will result from the training of teachers in this direction and from such assignments of class size as will permit the use of individual teaching. There are no data upon which to base a

[16] For a summary of these studies in Social Psychology, see *Science*, New Series, Vol. 31, No. 803, pp. 761 to 767. *Pedagogical Seminary*, June, 1905, pp. 214 to 230. See also Bibliography, pp. 229-230. Physiological Psychology by Ladd & Woodworth, pp. 532-533. See also the references cited in footnotes of these pages. *Pedagogical Seminary*, Vol. 7, No. 1, p. 13 ff.

[17] Other types of dynamogenesis are illustrated in Thomas's Source Book of Social Origins, p. 618 ff.

[18] Hall, Adolescence, Vol. II, Chapter XV.
Thorndike, Educational Psychology, Vol. I, Chapter VII.
MacDougall, Social Psychology.

[19] There may be a fallacy in this measure taken alone, for the condition may be influenced by pressure put on at school and at home, which compels the child to keep his place in school.

final prescription. We need a large amount of experimental work upon these various factors. If the present investigation points to anything, it indicates a serious condition in American teaching and supervision.

Recent careful studies of the physiology of children and of school hygiene indicate that no class properly seated may be larger than fifty. Dresslar, one of the most competent investigators,[20] in summarizing all of the researches made on this question, and the results of his own studies, suggests that classes may not economically be made much larger than forty to forty-five. The present investigation indicates the general lack of relationship between the size of classes as organized in the situations studied and the attainment reached in the subjects tested. The study most emphatically does not indicate that we should increase classes even to the extreme limits reported. The lack of relationship which is evident suggests a stupendous problem.

The optimum size for the most efficient instruction cannot be determined by the evidence at hand. Experimentation and further study are needed. We can only indicate certain general facts about the situation. At one extreme, tutorial instruction of the individual is undesirable because the social or group influences of education are absent. On the other hand, instruction in classes above fifty is absolutely undesirable because of physiological effects. Merely to reduce the size of the classes without changing the traditional method of teaching is not to add to efficiency in instruction. This is exactly what is being done in many of the current experiments in this country, and by the expressed opinions of many school men.

The evidence from the investigations of Dr. Rice[21] and his analysis of the bearings of these in American school practice give added force to these contentions. Dr. Rice makes clear that no one knows the amount of influence exerted by such factors as the age, nationality, heredity, and environment of

[20] Bulletin of the United States Bureau of Education, 1910, No. 5, p. 17 ff. School Hygiene, 1913, pp. 30-37, and pp. 57-73. In this connection such enactments relating to ventilation as have been passed by the legislatures of New York, Massachusetts, and Pennsylvania, are suggestive. See also Building Code of the State Board of Education of New Jersey, 1913.

[21] Educational Research—A Test in Arithmetic, *The Forum*, Vol. XXXIV, No. 3. The Futility of the Spelling Grind, *The Forum*, Vol. XXIII, Nos. 2 and 4. A Test in Language, *The Forum*, Vol. XXXV, No. 2. Language (continued): The Need of a New Basis in Education, Vol. XXXV, No. 3, p. 44 ff.

the pupils, the training and personality of the teacher, the methods of instruction or the like. These conclusions of Dr. Rice are held by competent students of education to-day, although the work of Thorndike and others is giving us answers to some of the elements of these elusive problems of education.[22] The present study indicates that we can probably not determine the precise influence of class size because of its complex interrelations with other factors, the amount and influence of which we are yet not able to estimate and eliminate by means of our present methods of measurement.

A careful perusal of the arguments of Dr. Rice and an examination of his data indicate that probably the attainment of children in school work represents very largely the ability of the children in things which they have worked out[23] or in the language of the modern psychologist, "the things to which they have reacted." Psychology presents much evidence to indicate that there is no learning of consequence which does not result from the "varied reaction" of the learner. Merely to "put through" the mind of the child as he deals with the material to be learned, is of little more consequence in human learning[24] than attempts to teach an animal an act by "putting it through" the various steps of that act. This is only another way of saying that the most economical learning will result from the economical arrangement of situations to which the pupil shall react. In the last analysis our school work must depend in large part upon the arrangement of situations and the securing of proper responses in the most economical manner. Dr. Rice's suggestion that the high probability that this depends largely upon the power of the teacher is only a half truth. The power of the teacher, aside from the influence of personality, will be manifested largely in the marshalling of situations in such a way as to bring about desirable responses. But there are other factors which may be brought into account, which will compel reaction on the part of the pupil and which may thus contribute very largely to securing optimum conditions for learning in

[22] Such studies as The Elimination of Pupils in the High Schools of New York City, by Van Denburg, give us important answers to certain problems.

[23] *The Forum*, Vol. XXIII, p. 415.

[24] Ladd & Woodworth—Physiological Psychology, Chapter VIII. See also A Study in Incidental Memory by Garry C. Myers, Columbia University Contributions to Philosophy and Psychology, Vol. XXI, No. 4. Thorndike, Educational Psychology, Vol. II, Chapters I-IV.

ways that are outside the control of the teacher. Such things are the group stimulus, and various other stimuli which are not consciously the result of the teacher's work in arranging situations and responses. Only a careful study of these separate factors, an estimation of their probable effect, and the resultant arrangement in proper combination can be expected to solve many of these important problems.

These considerations suggest that two definite things must be done at one and the same time:

First, the classes must be made smaller so as to make individual teaching physically and psychologically possible. The experience in the organization of classes of exceptional children in England, Germany, and the United States indicates that the limits are roughly ten and twenty-five.[25] Experiments carried on with normal children and exceptional children in this country, utilize in general class sizes within these limits. However, experimentation may show that these are not optimum limits. These limits which have been prescribed by law in some instances, and frequently by boards of education,[26] are not the result of experiment, but are rather the approval of certain types of practice that have been guessed at as satisfactory.

Second, the teacher must couple individual teaching with group teaching. It is incumbent upon supervisors to derive standards for individual teaching and to assist teachers in applying these in the group. Exactly what size this group must be in order to secure the optimum results cannot be determined from the evidence in this study, and it is doubtful whether it can be determined at present from any array of evidence collected in American schools, because there is not enough practice of individual teaching, either as a major method, or as a method of co-ordinate importance with methods of mass teaching in American schoolrooms to give us after the most painstaking collection of data, these needed facts:

First, how small must classes be so that the teacher can determine the individual needs of each member?

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[25] Bulletin of the United States Bureau of Education, 1911, No. 14. Red Codes of N. U. T. for 1908-1912. Bulletin of the United States Bureau of Education, 1907, No. 3.

[26] Laws of New Jersey, 1911, Article X. See also Manuals of Board of Education, New York City, 1911 and 1914, for sample provisions in the United States.

Second, how many must be in the group before the maximum of social stimulation is reached ?

Third, if maximum control, and maximum stimulation of the individual require a different sized group than that now generally organized, what size offers an opportunity for the optimum combination of these factors ? No one knows. The question can be answered only by a large amount of experimentation, for a study of situations in which all of the factors are not taken into account can do no more than establish the inadequacy of present procedure, or summarize a practice whose value may be far below that which carefully conducted experiments extending over several years or better through the entire elementary school life of a group of individuals indicate to be desirable.

APPENDIX I

GENERAL DIRECTIONS FOR THE ADMINISTRATION OF THE TESTS

1. In general, the investigator should provide uniform ruled paper similar to that used for composition work in the several systems to be tested for the tests in composition, handwriting and spelling. He should also provide a supply of pens of the kind the children are accustomed to using.

2. For the timing a good stop watch is desirable although not necessary. A good ordinary watch should be sufficiently accurate.

3. Use large envelopes about $10\frac{1}{2}$ x 12 inches.

4. Write on the outside of the envelope the following facts in order:

a. Name of City.
b. Name of building.
c. Grade.
d. Name of teacher.
e. Average daily attendance.
f. Time of day of test, i.e., time of beginning of test and time of ending of test.
g. Date of test.

Directions for the Administration of the Spelling Test

Upon entering the classroom obtain from the teacher a sufficient amount of ruled paper such as is used for ordinary composition work, to supply each pupil with one sheet.[1] Ask the regular monitors to distribute one sheet to each pupil. Then give these directions: " Write your name in the upper right-hand corner of the sheet. Under this state whether you are a boy or a girl. Under this write the date of your birthday. Under this write the number of years old you were at your last birthday.

" I wish you to write carefully some sentences which I shall dictate. Number them in order on the left."

In dictating these sentences read each one through twice, then at the signal, " Write," dictate the sentence in phrases as marked and allow the number of seconds indicated above each phrase for writing that phrase.

[1] Or supply the pupils with the uniform paper furnished by the investigator.

SPELLING TEST[2]

To test grade IV, dictate sentences, 1, 2, **3**, **4**, 5, 6; grade V, sentences numbered 3, 4, **5**, **6**, 7, 8; grade VI, sentences numbered 5, 6, **7**, **8**, 9, 10; grade VII, sentences numbered 7, 8, **9**, **10**, 11, 12.

III
1. I will *send*[3] (10″) | *forty* men. (10″)
2. Please *pass* (10″) | in *front* of me. (10″)

IV
3. He likes to *wear* (10″) | a white *button*. (10″)
4. The rope can just *touch* (12½″) | the *surface* of the water. (12½″)

V
5. I *believe* that your belt (12″) | is too *loose*. (12″)
6. They drove to the *circus* (12½″) | in a *carriage*. (12½″)

VI
7. He laughs and is *saucy* (12½″) | and keeps on *whistling*. (12½″)
8. They may fail in the *beginning* (15″) | but soon they will *succeed*. (15″)

VII
9. While *ascending* the stairs (10″) | he *slipped*. (10″)
10. You cannot *imagine* a person (15″) | with so bad a *character*. (15″)

VIII
11. He made a *peculiar mixture* (12½″) | of ashes and cement. (12½″)
12. The *intelligent* scholars (10″) | were all present (10″) | on this *occasion*. (10″)

IX
13. I can *guarantee* (15″) | that this girl (10″) | is *thoroughly conscientious* (18″) | and will never *disappoint* you. (15″)

When the last sentence has been dictated, and time allowed for writing the last phrase, give this signal: "All stop. Pens down. Blot your work. Monitors collect."

Fasten the papers together, and place them in a large envelope. On the outside of this envelope, record the facts indicated under *General Directions*.

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[2] The time for writing the sentences in this spelling test was standardized by dictating them to several hundred children. By means of a stop watch the time necessary to write each of the phrases was determined. These tentative standards were utilized throughout the study in order to make the results closely comparable.

[3] The words in italics are the standard words for each of the grades.

Directions for Administering the Composition Test

Upon entering the classroom obtain from the teacher a supply of paper such as is used in the regular composition work or use the uniform ruled paper you have selected for the testing. Have one sheet distributed to each pupil. Ask the pupils to prepare the paper in the same manner as indicated for the spelling test. Then, " Pens down."

Then say: " To-day I am anxious to have you write me a good story. I shall write a subject on the board and I want you to tell me the most interesting story you can. After you begin (and do not begin until I say " Go,") you are not to consult the dictionary nor to ask questions of anyone, not even your teacher. After I write the subject on the board you may ask me questions for a few minutes."

Then write on the board this subject: " How I would spend one hundred dollars to please five persons who like different things." Allow three to five minutes for questions which when answered give a clear understanding of what is wanted. Eliminate all others.

Then say, " Go," and allow the class to write twenty-two minutes. At the end of that time, "All stop. Pens down. You will now have a few minutes to look over your paper. Look through it carefully and make any corrections you wish without consulting anyone."

Allow three minutes for this, then, " Pens down. Blot your papers. Monitors collect."

Mark the set as indicated under the spelling directions.

Directions for the Tests in Handwriting

1. Use a ruled paper similar to that used in the systems tested. Where the school authorities are willing to furnish the paper the regular paper used for penmanship or composition may be used.

It is desirable that the investigator provide the pupils with clean pens of the kind used in the system.

2. Upon entering the classroom determine from the teacher what piece of poetry or prose containing thirty or more words has been memorized by the pupils. Often the investigator will find that different groups know different passages best. In that case allow each group to use what it knows best in the preliminary test. In tests II, III and IV it is well to attempt to confine the writing to two different passages, preferably one, because of the difficulty in getting the passages on the board as noted below.

3. Utilizing the regular monitors distribute one sheet of paper per pupil and pens in holders to the class. See to it that all are supplied with ink and blotters.

4. Have the class prepare this sheet by writing name, birthday, age and sex as indicated under the Spelling Test.

5. Test I. *Preliminary Test.* Have the pupils write the first stanza of the passage selected over and over from memory in exactly two minutes. While the class is writing record the names of any who do not remember the passage. Stop the writing at the end of that time, collect the papers, fasten them together, label as indicated for the other tests, and in addition, mark them, *Preliminary*, 120 *seconds*.

6. Test II. *Careful Writing Test.* Have the teacher write the stanza on the board. If there are two or three groups the investigator should write one or more of the passages on the board, thus assisting the teacher and saving time. Tell the pupils that you are anxious to see how well they can write. Tell them to write the first stanza over and over as carefully and as well as they can in the time allowed. Tell them to look at the board if they forget the passage. Start them on signal and allow exactly four minutes. Collect and label as indicated under (5) and put on additional label: *Careful*, 240 *seconds*.

7. Test III. *Writing Done at the Usual Rate of Writing.* Tell the pupils that you wish now to see how they write when they write about as rapidly as they ordinarily do. Give the same directions for the writing as indicated under (6). Start them on signal and allow exactly four minutes. Collect and label as indicated above. *Additional label, Ordinary*, 240 *seconds*.

8. Test IV. *Speed Writing.* "Now let us see how well you can write when you write very rapidly."

Distribute paper as before. "When I say 'Go,' take your pens and write the stanza over and over until I say 'Stop.' Remember, write as rapidly as you can and still write well."

Proceed as in Test III and allow four minutes. Label in addition, *Speed*, 240 *seconds*.

Directions for Giving the Tests in Range of Vocabulary

1. Distribute the test sheet numbered I and ask the monitors to place the sheet face down. See that the class is supplied with pencils. Then say: "At the signal, 'Go,' I wish you to turn this sheet up, read carefully what it says near the top and then do exactly what it tells you. Ask no questions. All ready. Go."

2. Allow three minutes for the test. Note any pupils that are unable to go ahead. Tell them individually to read what it says and do what it tells them.

3. At the end of three minutes, "All stop. Pencils down. Write your names below the work. Monitors collect."

4. If desired, the same facts with reference to age and sex as indicated in the spelling test may be recorded on this and the other sheets. This is not necessary if it has been done on one of the other test papers.

5. In the same manner distribute the test sheet numbered II Then say: " This sheet is similar to the one you have marked. At the signal, 'Go,' turn it over, read and do exactly what it says as quickly as you can."

6. Allow exactly three minutes. Stop the work and collect as indicated under (3).

7. In the same manner distribute the test sheet numbered III. Give the same directions as noted under (5).

8. Allow exactly five minutes. Stop the work and collect as indicated under (3).

TEST I

Write the letter **a** under every word that is the name of an animal. Write the letter **t** under every word that means a kind of tree or wood. Write the letter **b** under every word that means some kind of a book. Write the letter **g** under every word that means some kind of a game.

Remember—a, for animals
t, for tree
b, for books
g, for games

lion, tiger, pine, bible, oak, base-ball, primer, tag, deer, maple, snake, elm, willow, walrus, leopard, jack-straws, birch, tennis, giraffe, hickory, elephant, kangaroo, dictionary, dominoes, hemlock, croquet, gorilla, golf, novel, mahogany, walnut, encyclopedia, ledger, rhinoceros, parchesi, cypress.

TEST II

Write the letter **c** under every word that means a color. Write the letter **m** under every word that means a thing that makes music. Write the letter **w** under every word that means some thing that boys or girls wear. Write the letter **d** under every word that means some thing that a boy can do.

Remember—c, for colors
m, for things that make music
w, for things to wear
d, for things boys can do

red, green, guitar, hat, coat, run, work, play, shoe, jump, hide, piano, pink, cuff, shout, study, organ, reach, yellow, grasp, scream, collar, request, shiver, crawl, shirt, violin, violet, disagree, purple, inquire, scarlet, harp, flute, trumpet, practice, ramble, crimson, cornet, apron, mandolin, trespass, prevaricate, sweater, confess, ribbons.

TEST III

Write a letter **g** under every word that means something good for a boy or girl to be. Write a letter **b** under every word that means something bad to be. Write a letter **s** under every word that means something to do with school. Write a letter **t** under every word like " now " or " when " or " before " that means something to do with time.

Remember—g, for good things
b, for bad things
s, for words about school
t, for words about time

liar, fair, lesson, then, lazy, steal, teacher, honest, clean, kind, never, writing, sneak, reading, polite, before, useful, stingy, murder, spelling, arithmetic, cowardly, cruel, afterward, whenever, truthful, modest, upright, geography, graduate, recess, rascal, drunkard, obliging, later, deceitful, during, scoundrel, promotion, grade, generous, criminal, torture, loyal, history, miser, reprobate, earlier, courteous, penmanship, merciful, forger, courageous, craven, renegade, poltroon, reasonable, examination, considerate, deportment, discipline, defaulter, equitable, sycophant, preceding, philanthropic, hitherto, grammar, etymology, pretentious.

Directions for the Administration of the Test in Arithmetic

For the reasons cited in Chapter II, page 15, Test No. 7, Series A, of the Courtis tests was selected. The method of administering the test and the methods of scoring are identical with those used by Mr. Courtis, which have been described by him at length.[5]

[5] Directions for giving the Courtis tests, 1913. Final Report of the Committee on School Inquiry for New York City; 1911-1913, Vol. I pp. 397-546.

APPENDIX II

SAMPLES OF TESTS[1] GIVEN IN SYSTEMS H AND I

REPRODUCTION STORY

Will the principals please give this story in grades three and four, sending the papers to the office as usual? The title may be placed on the board. No questions are to be answered and the story is to be read but once, distinctly.

.....Superintendent.

THE OWL AND THE GRASSHOPPER[2]

A great white owl was sitting one day on her perch in a hollow tree. She was trying to get her afternoon nap. But a noisy grasshopper sang his song over and over again. The owl could not sleep. Finally the owl said, "Won't you keep quiet or else go away? I want to take a nap." But the grasshopper said, "I have as much right to sing as you have to sleep. Besides, you have never done anything for me." Soon the owl called out to the grasshopper, "Well, you have really a beautiful voice. Now that I am awake I don't wonder that you love to sing. Won't you let me offer you some of the delicious honey that I have here?" The silly grasshopper at once jumped up into the tree. The owl caught him in her sharp claws and then finished her nap in peace.

REPRODUCTION STORY

To be read by the principal in grades five, seven and eight, once only, and no questions answered. Aicha and Algeria should be written on the board. Papers to be marked with name of teacher, school and grade, and sent to the office as usual.

.....Superintendent.

[1] For the method of scoring these tests, see *The Psychological Clinic*, Vol. VI, No. 1 (March 15, 1912) pp. 1-12.

[2] All of the stories have not been reproduced. The "School of Stanz" is the original story used by Dr. Rice in his study of attainment in language. For text, see *The Forum*, Vol. XXXV, No. 2, p. 290.

THE TRICK OF OLD AICHA

Long ago a city in Algeria was besieged by a great army and the inhabitants were reduced to the last extremity. The mayor called together all the people and said: "My friends, we shall have to surrender the city. We have nothing to eat." "No, no," cried an old woman named Aicha. "Do not give up the city. I am sure that the army will go soon. Do what I tell you, and I promise you that the city will be saved." The mayor consented and the old woman said: "First, we must get a cow." "A cow," said he. "It will be impossible to find a single cow in all the city. All the animals have been killed long ago." The old woman insisted, and, after a long search, they found a cow at a house of an old miser who had hoped to sell it some day for a large sum of money. The mayor took away the cow in spite of the miser's objections.

"Now," said the old woman, "I must have some grain." "It is impossible to find any grain in this whole city," answered the mayor. But little by little they collected enough to fill a measure and brought it to the old woman. She ground it and gave it to the cow to eat. The mayor exclaimed: "Oh, you are giving this good grain to an animal when so many people are dying of hunger." The old woman said: "Only wait a little. The enemy will go away." Then she drove the cow out of the gate of the city and it stayed near there, eating grass. Some of the soldiers of the enemy came up, seized the cow, and led it to their camp. When their king heard where they found it, he cried: "Surely, the people in the city cannot be without food, as I thought, for if they were hungry they would have eaten this cow. They must have more food then we. It is long since we had any fresh meat. Well, kill this animal and you shall have a good dinner."

But when the soldiers killed the cow, to their surprise they found a quantity of grain in her stomach. The king said: "If those people have enough grain to feed their animals they are better off than we. We shall die of hunger before they do. It is useless for us to wait for the city to surrender." So the king marched away with his army and the city was saved.

The grateful people carried the old Aicha in a triumphal procession all around the city and gave her so much money that she lived in comfort all the rest of her life.

Cornelia's Jewels

Once upon a time many long years ago there lived a lovely lady. Her name was Cornelia, and her home was in the great city of Rome. Cornelia had two little sons whom she loved very tenderly; and the boys, on their part, were very fond of their beautiful mother. One day a lady came to call upon Cornelia. She was dressed very richly in silk and velvet. Around her neck were heavy gold chains, in her hair were shining rubies and diamonds. Her fingers sparkled with expensive rings. She brought with her a wonderful jewel-box in which were other chains and rings and precious stones of every kind.

All these things the lady showed to Cornelia, who admired them very much. When the last jewel had been put back into the box, the visitor said, "I have shown you all my treasures. Where are yours? Pray let me see them."

At this moment Cornelia's little sons came running home from school. Holding them fast in her arms, Cornelia said proudly, "These are my riches. While I have them, I do not need either gold or jewels. They are the most precious treasures in Rome or in all the world."

GRADE 3. REPRODUCTION

Dick's Cat

Dick's bed was in an attic. At night many rats and mice came through holes in the floor and made so much noise that he could not sleep.

One day he saw a girl with a cat. "I will give you a cent for your cat," he said. The girl took the cent and gave Dick the cat.

He took it home. Soon there was not a rat nor a mouse left in the attic. Then Dick could sleep well every night.

GRADES 3 AND 4. REPRODUCTION

The Two Goats

Two goats met in the middle of a bridge. It was only wide enough for one to cross over at a time. Neither goat was willing to go back and let his friend pass by. They began to fight and both of them tumbled into the water below. Their wetting taught them better manners.

GRADE 4. REPRODUCTION

TWO MEN AND THE BEAR

Two men once said they would travel together and help each other. They had not gone far before they saw a great bear.

One of the men said, "Together we can kill it." But the other man ran and climbed a small tree. The first man had now no time to get away. What did he do? Why, he fell upon his face. He lay still, as if he were dead. It is said that a bear will not eat a dead man.

The great bear came up and smelled the man. But he lay quite still. So it left him and went away.

Then the other man came down from the tree. "My friend," he said, "the bear seemed to whisper in your ear. What did it say to you?"

"It gave me some good advice," said the man. "It told me never to travel with one who leaves me when danger comes."

GRADE V. SPELLING TEST[1]

1. My *daughter* is *eighteen* years old.
2. On her *journey* she saw many *cities* and *islands*.
3. The *canoe* was *built roughly*.
4. *Surely* the *grocer* has *fruit* of some kind in that *barrel*.
5. *Perhaps* he has *molasses* in it.
6. Those *women* find it *icy walking*.
7. They who do *mischief* get into *trouble*.
8. Tie your *handkerchief* around your *thumb*.
9. I *promise* to bring *knives* and *leather* for the work.
10. The *rabbit* ran *against* the fence.

Marked on *italic* words. They are from lists of previous years.

GRADE IV. SPELLING TEST

Where did the *robin build* its *nest?*

He made it in the *apple tree away* from the *house*.

The *robins* were *afraid* of our *children*, but they *would* not hurt the *birds*.

[1] Unfortunately it is impossible to give the relative difficulty of the various words used in the spelling tests presented here because all of these words have not been evaluated. Roughly those for Grade V as determined by Buckingham represent approximately fifth grade ability; the words for the other grades are relatively too easy.

Tom, the cat, is the *one who likes* birds for his *supper*.
Their nest was made of *sticks* and *grass*.
Perhaps there will be as *many* as four *young* robins in it.

Grade III. Spelling Test

My sister had a cent. She went to buy some candy. What did she get? The man gave her five candy balls. He was good to her. She likes him. He lives west of the school. My sister goes to see him.

Words included are from lists of previous years.
Marked simply upon *spelling*.

Grade II. Spelling Test

bird	four	nest
box	egg	tree
doll	have	wish
fish		

dictation for grade II

Will the principals please read the enclosed exercise through once, distinctly, then a sentence at a time for the children to write? Each sentence is to be read but *once* for the dictation.
The large paper need not be used. Please send the papers to the office at once without ranking them.

Dictation

My mother says I may come to your house. Then you shall see my two dolls. One is big and one is little. I went home to get them. When school is over we will play with them.

dictation (spelling)

The accompanying dictation exercise for Grade I contains twenty words from the spelling list.
Each sentence may be read loudly and distinctly twice only, and no questions are to be answered. The *teacher* should read the sentences, but in order to prevent misunderstandings and ensure exact uniformity in the way the test is given throughout the city, the principal is asked to remain in the room during the period.
Each teacher is asked to mark at the top of each paper the number of words incorrectly spelled, taking into consideration

only the twenty words underlined in the model. Attach to the front of each set of papers a slip bearing the summary of the work, as follows:

School 6 Grade 1 Miss.....

Number of papers with

0	1	2	3	4	5	6	7	8	9	10 (or more errors)
25	2	3	0	2	0	0	1	2	0	0 (number of papers)

DICTATION

1. I have a *ball.*
2. The *little star* is in the sky.
3. Do you *want* a *red apple?*
4. *Baby* has *three dolls.*
5. I saw *seven sheep.*
6. My *father* has a *horse* and a *pig.*
7. My *brother* is in the *house.*
8. *There* is a *white egg* in the *nest.*

Please send the sets of papers with attached slips to the office as soon as possible; by Friday at the latest.

.....Superintendent

REPRODUCTION

Will the principals please give the enclosed reproduction story in the third and fourth grade room which did not have the story of " The Cat and the Monkey " a few weeks ago?

Please send the papers to the office as usual.

For the third grade the title and the words *creep, hungry, plenty,* should be written on the board; for the fourth grade, the title only.

THE GRASSHOPPER AND THE ANT

Once there was a grasshopper who would not do any work. He liked to play in the sun. The little ant worked hard all day. At last cold days came. Then the ant had plenty of food in its warm house. The grasshopper had to creep under a stone. He was cold and hungry.

APPENDIX III

PRELIMINARY LIST OF COMPOSITION SUBJECTS

How I like best to spend a day at home.

How I spent the happiest day of last vacation.

Write an account of how you will spend next Thanksgiving.

Write an account of how you will spend next Christmas.

My favorite amusement.

What I should like to be and do when I am a man (or woman).

The most exciting game I ever played.

My favorite out-of-door play.

Write a letter to your best friend telling him about the things most interesting to you.

The most pleasant birthday I ever spent.

The unhappiest birthday I ever spent.

Write a letter describing a day at this school.

A picture story. See type in Baker and Thorndike's Language Book, Part I, pp. 124-125.

An incident in my summer vacation.

How I made my garden.

How I would spend one hundred dollars.

How I would spend one thousand dollars.

How I would spend one thousand dollars to please five persons who like different things.

How I would spend one hundred dollars to please five persons who like different things.

NOTES ON THE TESTS

The test in English composition might well be improved by permitting each teacher to suggest the amount of money which in her judgment members of the class can best write about. This would have a tendency to make the results less comparable than they are now but on the other hand might very well provide for greater freedom in composition.

Every effort has been made to see that the tests in English composition as well as those in all other subjects were not drilled upon. Every precaution was taken by giving all the tests of one kind on the same day. For this reason it was absolutely impossible for the teachers in any grade to prepare their pupils in advance.

The standards in handwriting discussed on pp. 35-36 pertain to " muscular movement " writing.

APPENDIX IV

NOTES ON MEASUREMENT OF CLASS SIZE

A

TABLE I

RECORDS OF 500 CHILDREN SELECTED FROM SYSTEMS A, B, C AND SYSTEM E*

Per cent of pupils in each group that reaches or exceeds the standard medians.

	Composition	Arithmetic	Writing	Vocabulary
Grade V				
Small classes E	70.0	42.4	61.0	68.6
Large classes A-C	36.9	25.5	42.07	21.8
Grade VII				
Small classes E	72.15	87.34	59.5	29.1
Large classes A-C	48.9	43.8	48.8	15.0

TABLE II

RECORDS OF 610 CHILDREN SELECTED AT RANDOM

Per cent of pupils in each group that reaches or exceeds the standard medians

	Composition	Arithmetic	Writing	Vocabulary
Grade V				
Small classes	39.23	37.3	45.0	70.9
Large classes	34.34	25.5	70.4	33.8
Grade VII				
Small classes	40.1	55.5	40.0	39.7
Large classes	45.1	32.1	56.9	29.3

*These groups were selected deliberately that comparison might be made between a group of children in each grade that had been taught for four years in small classes with a group that had been taught for the same number of years in large classes. The school population is for all practical purposes identical. The teachers of the groups compared are roughly of the same ability. The comparison is not as fair as that presented in Table II.

The above tables are self-explanatory. One-half of the children have been taught in classes of 25-35 for four years· the other half have been taught in classes of over 40 for four years. When the records of individual pupils, to the number indicated in the tables, are compared with the tentative standards suggested in Chapter III the superiority of the attainment of pupils who have been taught in small classes for a number of years is evident to a limited extent. However, as pointed out before, the presence of other factors is likely to exert an influence which cannot be explained by class size alone.

Of course the systems are to some extent not comparable although the factor, character of population, does not apparently exert any influence when the results are tabulated in this way. Measured by the per cent of classes that reaches or exceeds the standards of Chapter III, the small class systems seem to be the most successful in grade five. But the fallacy of selection affects any interpretations such as those offered above because the small class systems here reported have more money to spend and this is generally true over the country. Thus such systems select the better teachers and provide better school facilities.

B

For the purpose of studying more completely the relationship of the size of class for the present year and for four years to attainment as set forth in Table VI, pp. 41-46, the classes were arranged in order of excellence in attainment and the attainments compared with the class sizes.

When this is done and the attainment compared with the size of class for four years we find in grade five that small classes are superior in writing, range of vocabulary and spelling. Measured by size of class for the present year the effect of class size is negligible except in the case of range of vocabulary. In grade seven, measured by size of class, for four years the small classes are decidedly superior in spelling, arithmetic and range of vocabulary. Measured by the size of class for the present year small classes have a decided effect only in arithmetic and spelling. In this grade the size of class seems to be a factor of less influence than in grade five.

APPENDIX V

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